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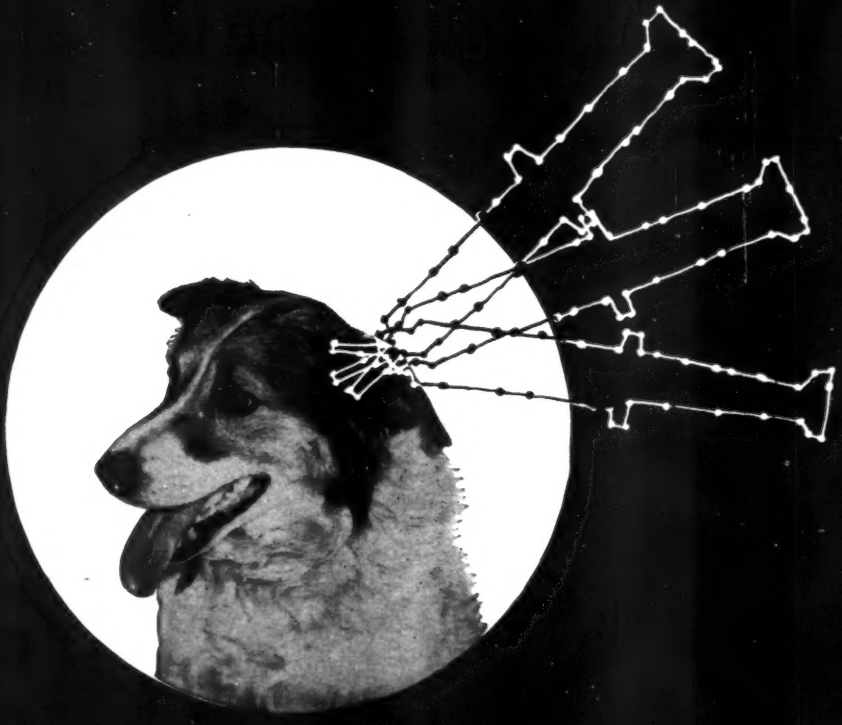

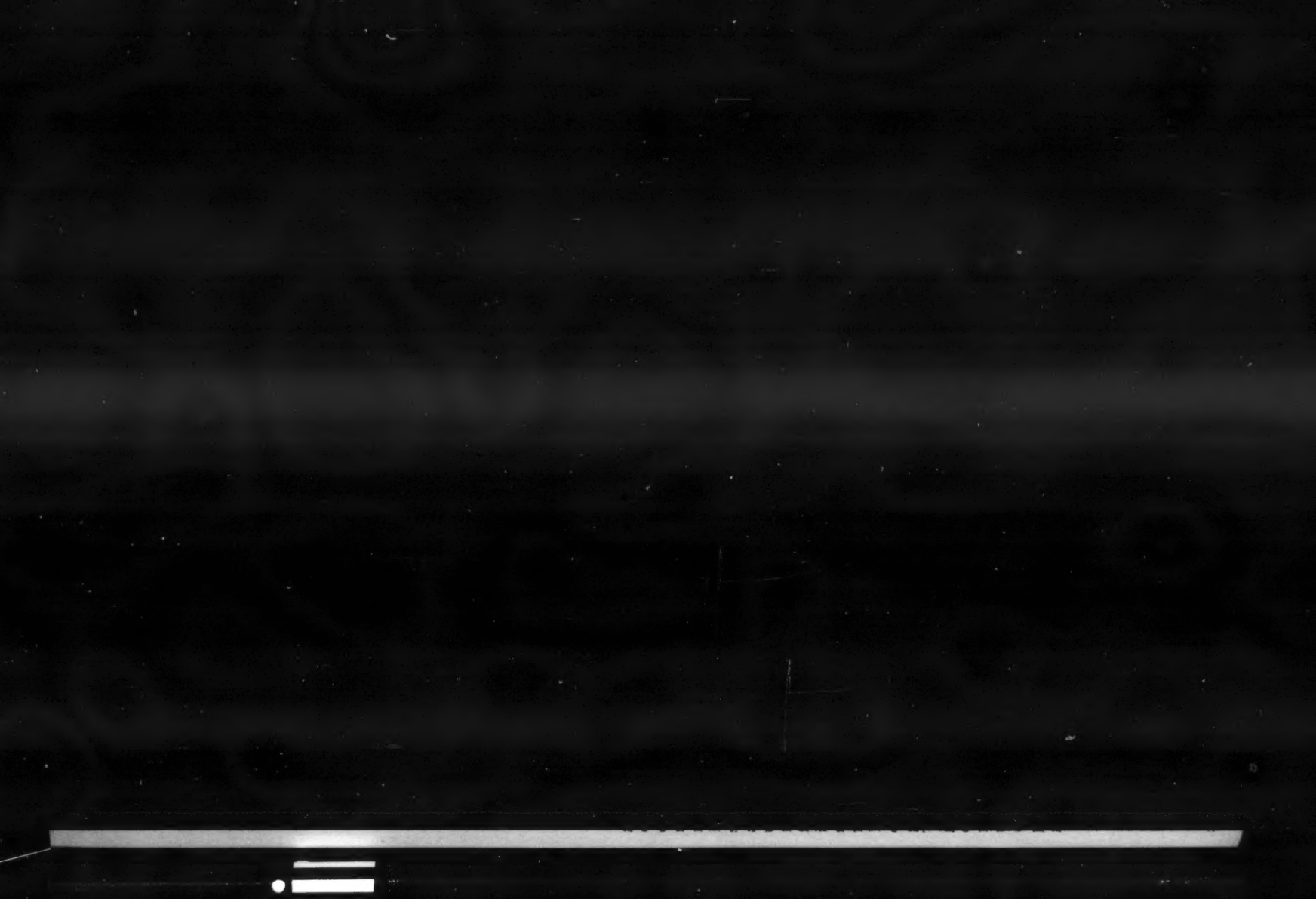

Experimental Feeding Of Low Level Phenothiazine To Florida Cattle†

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CATTLEMEN and dairymen are improving pastures in Florida. Better pasture programs have increased the amount and quality of feed per acre. This means larger numbers of cattle pastured per acre and consequently more manure passed onto the ground with a rapid buildup of parasite eggs and larvae. During the years 1952 and 1953, 73% of fecal samples received from veterinarians, county agents, and cattlemen were positive for the usual gastrointestinal parasites. Many ranchers feel that good feed will prevent death losses from parasitic infections. The writers concur in this theory to the extent that well-fed animals are more able to withstand parasitic infections because they are properly nourished. However, one rancher had cattle on an excellent pasture of red clover and Bermuda grass when they began dying from parasitism. There were too many animals permanently grazing over a restricted area. With high incidence of parasitism in Florida came the desire for an easier and more efficient means of controlling internal parasites. This experiment was conducted in an attempt to evaluate low level phenothiazine on a continuous medication program over a period of one year.

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Review of Literature

Andrews, Muniz and Orihuela[1] reported that daily administration of 0.5 gm. of phenothiazine per 100 lb. of body weight to cattle in Puerto Rico suppressed egg production of *Haemonchus contortus, Trichostrongylus axei,*

General view of Pangola grass plots with feed shelters used in the experimental feeding of low level phenothiazine.

Bunostomum phlebotomum and *Oesophagostomum radiatum*. Egg production of Cooperia spp. and *Strongyloides papillosus* was not markedly reduced with this dosage. Brock, Pearson, and Kliewer,[2] using daily doses of 0.25 gm., 0.5 gm. and 1 gm. of phenothiazine in calves, found slight suppression of gastrointestinal nematode egg production. A 2 gm. daily dose resulted in marked suppression of egg production. In addition, a therapeutic dose of phenothiazine before low-level feeding

TABLE 1. Parasites Found on Autopsy of Calves Which Died Before or During the Experiment

Animal		Lung	Stomach		Large intestine		Small intestine				
No.	Date died	D. viviparus	H. contortus	O. ostertagi	T. axei	O. radiatum	T. discolor	Cooperia spp.	B. phlebotomum	Monieza spp.	S. papillosus	Larvae
57	10-31-52	0	1,766	1,300	766	554	38	42,900	300	0	0	Not counted
58	11- 7-52	0	0	16,400	25,800	179	0	7,483	7	2	550	5,000
55*	12-19-52	38	333	1,850	0	167	13	34,300	70	0	0	Not counted
56*	1-30-53	0	1,460	4,433	1,966	362	23	33,566	24	0	0	3,666
28**	1-10-53	39	3,400	3,300	10,400	4,500	150	53,560	0	0	0	11,575

*These two calves were part of the Dairy Breed Reservoir calves used to seed pastures and were too weak to use in the experiment.
**Died during experiment while in group 3 on low level phenothiazine in concentrate feed.

gave better results than daily doses alone. Losses in a herd of 500 calves from *Dictyocaulus viviparus,* lungworm infection, were found to be reduced in number using a 2-gm. phenothiazine per calf per day regime. Cauthen[3] culturing fecal samples from four yearlings and five calves, found 60% development of larvae in the controls, 13% using 0.5 gm. phenothiazine fed daily, 2.5% when 0.7 gm. was fed, 0.9% when 1 gm. was fed and 0.6% when 1.5 gm. were fed. Mayhew[4] reported on feeding 1.5 gm. of phenothiazine daily for 28 days during the prepatent period of a pure infection of the nodular worm, Oesophagostomum spp. This program delayed the normal production of eggs but did not stop it completely. He mentioned one animal producing infective larvae on this program and that such animals serve as a source of infection unless continuous feeding of the drug is practiced.

Harwood, Guthrie aand Preble,[5] using a one part phenothiazine and ten parts salt mixture fed free-choice to steers on pasture, reported a greater weight increase per animal and a reduction in parasite egg counts in the treated group over the controls. They report a mean daily consumption of more than 0.5 gm. phenothiazine per 100 lb. of body weight. Herlich and Porter[6] report a daily consumption of 0.0 to 3 gm. phenothiazine per head per day using a 1-9 phenothiazine mineral mix. This resulted in effective control of *H. contortus* and *O. radiatum.* There was no significant effect on *Ostertagia ostertagi, T. axei, Cooperia punctata* or *Nematodirus helvetianus.* They also found a mineral base preferable to a salt base to assure consumption of adequate levels. There was no significant difference in average weight gains between treated and control animals. Turk, Jones, and Crouch,[7] using unweaned calves harbouring a light parasite load, reported no difference in weight gains of phenothiazine-treated animals over untreated controls. Talmage, Trum, Monroe, and Rust[8] reported that it appears that some preparations of phenothiazine NF (green) are capable of suppressing thyroid function. They also state that some of these contain approximately 0.3% organically bound iodide.

Experimental Animals and Plots

During the summer of 1952, 15 grade dairy calves that had been used in laboratory work on toxicity studies with coccidiostatic drugs were allowed to range over six fenced plots, numbered 1-6, of approximately one acre each. They subsisted on grass alone. In plots 1-5 the grass was Pangola and in plot 6, common Bermuda. This helped to insure equal parasitic infections on these areas. Subsequent deaths of several of these animals from parasitism proved that a heavy infection was present. Table 1 shows the parasites found on autopsy of dairy calves 57 and 58, which died while

TABLE 2. Monthly Averages; Grams Phenothiazine Consumed / Animal / Day*

Gp.	Dec. 52	Jan. 53	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.
1	0	0	0	0	0	0	0	0	0	0	0	0
2	0	0	0	0	0	0	0	0	0	0	0	0
3	1.3	1.7	1.7	1.7	1.8	1.9	1.8	2.0	2.0	2.3	2.5	2.5
4	1.0	1.4	1.5	1.4	1.6	1.6	1.6	1.8	1.9	2.1	2.2	0
5	1.0	.67	0	.65	1.3	.27	.38	.7	.5	1.6	1.1	.73
6	.46	.25	.37	.11	.7	.37	.75	1.1	1.0	2.6	0	0

*This does not include phenothiazine given as a therapeutic dose.

grazing on the areas. The other three calves that died at this time were autopsied, but parasites present were not counted.

An alternate pasture consisting of approximately five acres of Bahia grass was grazed by parasitized animals to establish infection in the area. This area was cross fenced into plots numbered 1A to 5A, but was not used in this experiment until April 1, 1953. An adjacent pasture of approximately one acre of mixed, native grasses and clover was numbered 6A.

On October 15, 1952 and November 4, 1952 a commercial cattleman* delivered on loan to the Agricultural Experiment Station, University of Florida, a total of 40 cross-bred range calves and furnished all concentrates and hay for the duration of the experiment. These animals were rough in appearance, thin, anemic and exhibiting the usual symptoms of low-grade parasitism. They were wild and difficult to handle, yet were representative of Florida commercial range calves. It was found necessary at the beginning, and during the early progress of the experiment, to replace several due to deaths from injury and parasitism.

After number-branding, castration, dehorning, and vaccination, these range animals were placed with the reservoir dairy animals and allowed to graze on plots 1-5. On November 17, 1952 the animals were separated into five groups of eight range animals and two dairy animals per group with the original weights of the groups nearly equal. The five groups each were placed on a Pangola plot which had been exposed to the reservoir calves all summer. Groups 4 and 5 were on slightly smaller Pangola plots than were groups 1, 2 and 3.

After separating into groups and prior to the actual start of the low level feeding of phenothiazine, it was noted that the dairy calves were unable to fend for themselves and were removed. Group 6 then was formed with eight dairy calves and placed in plot 6. This left eight animals per plot in all six plots. The remaining two dairy calves were too weak and debilitated for the experiment, and subsequently died. The autopsy report of these calves, 55 and 56, is included in table 1. On May 9, 1953 it was found necessary to reduce animals in groups 1-5 from eight to six animals per plot as the grass was short and the cattle

Group 1 (controls). Animals at the end of the 12-month experimental period.

too large and uncontrollable. In addition, three of the animals in group 2 and one in group 3 were replaced by new animals. This change made a total of six per group for groups 1-5 while eight remained in group 6 for the remainder of the experiment.

Materials and Methods

Initial blood and fecal samples were taken at the time the groups were formed. All blood samples mentioned in this report were analyzed for percent of red blood cells, grams of hemoglobin, milligrams percent of calcium and phosphorus*. Free-choice consumption of salt and minerals was found below normal for all groups. Practical experience at this station has shown that many range cattle in Florida must be fed salt and bone meal in concentrates for a short period to acquaint them with

*Weinstein Brothers, St. Augustine, Fla.

*The authors are indebted to the Nutrition Laboratory, Department of Animal Husbandry, Agricultural Experiment Station, University of Florida for this analysis.

TABLE 3. Total Phenothiazine, Minerals and Concentrates Consumed During Period of Experiment

Group	Salt lb.	Bone Meal lb.	Red Mineral lb.	C.S.M. lb.	Molasses lb.	Phenothiazine gm.	Concentrate lb.
1	75.7	9.5	27.9	0	0	0	7,852
2	104.1	10.5	33.1	0	0	217	7,702
3	92.4	2.4	25.5	0	0	4,792	7,826
4	124.7	4.9	41.9	0	0	3,575	7,570
5	286.0*	13.6	36.0	907**	0	2,114	7,622
6	117.6	22.0	57.5	0	2,933	2,057	8,368

*This includes salt from the cottonseed meal and salt 4-1 vehicle used in this group since March 10, 1952.
**Cottonseed meal used from March 10, 1952 to end of experiment, but does not include cottonseed meal in concentrates fed to all groups.

these essential minerals before they will consume them free choice. Therefore, bone meal and salt were fed all animals in the concentrates for ten days.

Group 1 served as controls and received no phenothiazine at any time. Group 2 received one initial therapeutic dose of 10 gm. of phenothiazine per 100 lb. of body weight and received no other treatment; they served as semi-controls. Group 3 was placed on 0.5 gm. of phenothiazine per 100 lb. of body weight in ground concentrate daily for the 12-month period of the experiment. Group 4 received a therapeutic dose at the start of the experiment and then was placed on 0.5 gm. per 100 lb. of body weight in ground concentrate daily for 11 months. Group 5 was offered phenothiazine free choice at a predetermined dose level of 0.5 gm. per 100 lb. of body weight per animal per day after an initial therapeutic dose was given. In group 5, materials used as a vehicle for phenothiazine consumption were: (1) Seminole brand stock mineral (red mineral), (2) Vit-L-Tone stock mineral (red mineral)**, (3) common table salt, and (4) cottonseed meal four parts—common table salt one part. Group 6 received a therapeutic dose of phenothiazine on November 6, 1952 and a repeat dose on December

Group 2. Animals at the end of the 12-month experimental period. [Received one initial therapeutic dose of phenothiazine (semi-controls)].

2, 1952 as they were heavily parasitized. They were then offered phenothiazine free choice at a dose level of 0.5 gm. per 100 lb. of body weight in molasses (citrus or cane).

At the start of the experiment the grain ration for all animals consisted of equal parts of citrus pulp and corn chop. The cattle did not eat this mixture readily. On January 5, the grain ration was changed to equal parts of corn chop and a molasses grain feed. On May 9, the feed again was changed to a mixture of ten parts citrus pulp to one part cottonseed meal, which remained the concentrate ration for all animals for the remainder of the

**Furnished by Jackson Grain Company, Tampa, Fla.

TABLE 4. Combined Average Eggs of *H. contortus* and *O. radiatum* / Gram of Feces / Animal / 14-Day Period*

Period		Gp. 1	Gp. 2	Gp. 3	Gp. 4	Gp. 5	Gp. 6
	Initial	122	285	98	165	240	29.3
1	12- 6-52	102	141	150	218	290	19
2	12-21-52	116	36	9	19	157	13
3	1- 5-53	159	52	1.5	33	27	16.5
4	1-19-53	96	45	3	3	7.5	4.5
5	2- 1-53	100	23	1	1	22	27.5
6	2-14-53	45	22	1	2	77	44
7	3- 1-53	98	16	1	6	78	24
8	3-15-53	43	25	0	5	18	7
9	3-29-53	50	10	1	27	12	10
10	4-12-53	24	10	1	0.5	27	4.5
11	4-26-53	29	10	0	0	3	1.5
12	5-10-53	11	10	1	3	42	6
13	5-24-53	6	26	2	1.5	36	35
14	6- 7-53	2	27	1.5	21.5	27	76
15	6-20-53	1	15	7.5	3	18	8
16	7- 5-53	0.5	28	1.5	3	12.5	10
17	7-19-53	0	18	3.5	1.5	6	2
18	8- 2-53	1	47	2	0.5	4	7
19	8-16-53	0	94	2.5	3	4	4.5
20	8-30-53	1	38	1	3	2.5	12
21	9-13-53	0	24	0	1.5	3.5	5
22	9-27-53	0	18	0	0.5	2	3
23	10-11-53	0.5	14	0	1.5	0.5	5
24	10-25-53	0.5	8	0	0	3	2
25	11- 8-53	0	2.5	0	3	0.5	0
26	11-22-53	0	12	0	1	0	11

*Because of the similarity in size and shape of the ova *H. contortus* and *O. radiatum*, no attempt was made to differentiate between them.

experiment. All groups received concentrate feed daily at maintenance level for the one-year duration of the experiment. No attempt was made to feed for weight gains. Pangola and Bahia hays were given free-choice as shortage of grass on the plots dictated.

Rotation of animals on pastures started April 1, 1953 and continued at two- to four-week intervals as growth of grass allowed such rotation. At no time was there an overabundance of pasture forage. All pastures received the recommended fertilization for this area, including addition of ground limestone. Assignment pasture numbers were the same as group numbers and were permanent for each group.

Salt was allowed free-choice to all groups for the period of the experiment; however, bone meal free-choice was allowed only until January 15.

Seminole brand stock mineral mixture containing ground limestone, steamed bone meal, deflourinated rock phosphate, common salt, cane molasses, and cottonseed meal, plus trace elements iron, copper, and cobalt, was fed free-choice until January 15. This mineral mixture was not sufficiently palatable and was not a good vehicle for phenothiazine adminis-

tration in group 5. Therefore, on January 15 it was changed to a more palatable one which contained the same ingredients as above with the elimination of ground limestone and with the addition of a private formula vitamin-mineral supplement with more molasses and cottonseed meal. As this mixture contained sufficient available essential calcium and phosphorus for cattle, it was decided to eliminate free-choice bone meal.

Phenothiazine incorporation into the different vehicles presented a problem. The drug was first hand mixed with the vehicle for each day for each test group. Later, a home-made mixing machine became available which greatly facilitated mixing. In the case of molasses, phenothiazine was mixed by hand as needed for the duration of the experiment by using a Waring blender to incorporate the powdered anthelmintic in a small quantity of water which was then added to the molasses and stirred in with a wooden paddle. Phenothiazine used in the molasses mixture given to group 6 was a wettable NF green powder, whereas all other groups received non-wettable NF green powder. All therapeutic doses were in the form of a standard commercial drench containing 10 gm. wettable NF green phenothiazine per oz. of drench. The therapeutic dose given was 10 gm. per 100 lb. of body weight.

The experiment officially began on December 1, 1952. Thereafter, all animals were brought into the corrals by groups in rotation, individually weighed, and fecal samples collected directly from the rectum. The rotation cycle occupied a two-week period. After the initial bleeding, blood samples were taken in February, June, and November of 1953. All animals in the experiment were sprayed periodically with 0.5% toxaphene wettable powder to control lice, flies, and ticks. A record was obtained of rainfall, temperature, and dew during the period of the experiment[‡].

Larval culture was not attempted until the last three months of the experiment. Fecal samples from all groups were cultured in September, October, and November (see fig. 1). Larval culturing was done to determine if any correlation existed between the controls and treated groups relative to viable parasitic larvae especially after removing groups 4 and 6 from low level administration. No attempt was made to identify each larvae. The fecal samples were cultured using a modified Cauthen[9] technic.

[‡]The authors are indebted to the Department of Agronomy, Agricultural Experiment Station, University of Florida for these records.

Group 3. Animals at the end of the 12-month experimental period. (Low level phenothiazine daily, in feed concentrates, for 12 months. Lineback animal in foreground is 36, referred to in manuscript).

Group 4. Animals at the end of the 12-month experimental period. (Received one therapeutic dose of phenothiazine and then low level phenothiazine in concentrate feed for 11 months).

Group 5. Animals at the end of the 12-month experimental period. (Received one therapeutic dose of phenothiazine and then low level phenothiazine free-choice in salt or mineral or cottonseed meal and salt for 12 months).

The experiment officially ended December 1, 1953, and animals were slaughtered.

The analysis of thyroids from animals in the experiment for iodine content was made according to the method described in the 14th edition of the United States Pharmacopeia.

After extracting the minced organs with

isopropyl alcohol, procedure as outlined by DeEds and Thomas[16] was followed in determining phenothiazine or phenothiazine oxidation products present in the spleen, liver, and kidney of animal 36, which had been on phenothiazine continuously for one year†.

Results and Discussion

The control group (group 1) did not receive phenothiazine at any time before or during the experiment, whereas animals in group 2 received a therapeutic dose of phenothiazine at the start of the experiment (see table 3). Groups 3 and 4 were fed phenothiazine in feed at a rate of 0.5 gm. per 100 lb. body weight daily.

Group 3 ate the anthelmintic in the feed concentrate readily every day during the experiment. This group consumed an average of 1.3 gm. per animal per day for the first month with a gradual increase to an average of 2.5 gm. per animal per day maximum intake at the end of the experiment (see tables 2 and 3). They did not receive a therapeutic dose.

Group 4 was reluctant to consume the phenothiazine-concentrate mixture until ten days after therapeutic dose was given. From that point on they ate the medicated feed concentrate readily, consuming 1 gm. of phenothiazine per animal per day average during the first month of the experiment. The gradual increase of intake reached a maximum of 2.2 gm. per animal per day average per month by the end of the 11th month when the drug was removed from the concentrate mixture for the group (see tables 2 and 3).

Group 5 received one therapeutic dose of phenothiazine and then was offered the anthelmintic in the Seminole brand stock mineral at a ratio of one part phenothiazine to 16 parts mineral mixture. They ate the mixture readily for one week and gradualy tapered off consumption, finally refusing the mixture. A phenothiazine-salt (1-25) mixture was offered and consumed for a few days but gradually tapered off until the animals again refused the mixture. Phenothiazine-Vit-L-Tone (1-16) then was offered for 28 days and, when no consumption occurred, the mixture was removed. For the next 31 days phenothiazine was withheld from this group. Cottonseed meal-salt mixture (4-1) then was given for three days to determine daily consumption. It was eaten readily and phenothiazine then was incorporated in the mixture at a ratio of

†The authors are indebted to W. M. Lauter, Ph. D., Professor of Pharmaceutical Chemistry, College of Pharmacy, University of Florida for conducting these tests.

TABLE 5. Combined Average Eggs of *T. axei* and *O. ostertagi* / Gram of Feces / 14-Day Period*

Period		Gp. 1	Gp. 2	Gp. 3	Gp. 4	Gp. 5	Gp. 6
	Initial	14	10	14	27	13	0
1	12- 6-52	22	15	12	7	12	2
2	12-21-52	25	24	21	3	32	9
3	1- 5-53	36	14	31	10	2	1.5
4	1-19-53	29	30	20	8	5	2
5	2- 1-53	48	13	12	5	3	4
6	2-14-53	10	13	7	7	2	2
7	3- 1-53	15	4	2	6	4	6
8	3-15-53	12	3	6	5	1.5	3
9	3-29-53	17	2	3	8	7	13
10	4-12-53	10	3	1	7	8	15
11	4-26-53	13	3	8	12	8	23
12	5-10-53	8	2	1.5	29	31	1.5
13	5-24-53	15	14	5	21	8	12
14	6- 7-53	2	6	2	9	8	3
15	6-20-53	4	7	5	12.5	6.5	14
16	7- 5-53	4	9	3	14	11	13
17	7-19-53	0.5	3	1.5	9	8	20
18	8- 2-53	1	3	0.5	6	5.5	26.5
19	8-16-53	3	9	0	5.5	16.5	36
20	8-30-53	0.5	7	2	7.5	6.5	24
21	9-13-53	0.5	10	2	3.5	3.5	15
22	9-27-53	0	9	1	5	7.5	13
23	10-11-53	0.5	4	0	9.5	1.5	20
24	10-25-53	1	5	0	6	7	17
25	11- 8-53	0.5	8	0	13.5	6	16
26	11-22-53	2	6	0	9	1.5	21

*Because of the similarity in size and shape of the ova *T. axei* and *O. ostertagi*, no attempt was made to differentiate between them.

TABLE 6. Average Eggs of *B. phlebotomum* / Gram of Feces / Animal / 14-Day Period

Period		Gp. 1	Gp. 2	Gp. 3	Gp. 4	Gp. 5	Gp. 6
	Initial	1.5	0	3	0.5	4	5.6
1	12- 6-52	2	2	0	3	3	2
2	12-21-52	5	0	4	0.5	0	3
3	1- 5-53	3	0	3	2	4.5	6
4	1-19-53	7	1.5	1	3	3	4.5
5	2- 1-53	14	0.5	3	1.5	4	4
6	2-14-53	4	1	1	3	1.5	2
7	3- 1-53	9	1	0.5	0.5	4	1.5
8	3-15-53	3	1	0.5	1	3	2
9	3-29-53	2	0	1	0.5	3	1
10	4-12-53	1.5	0.5	0	0.5	1	0.5
11	4-26-53	2	0	0	0	0.5	0.5
12	5-10-53	3	0	0	0.5	1.5	1
13	5-24-53	0.5	0	0	0	3.5	1
14	6- 7-53	0.5	0	0	0	1	2
15	6-20-53	0	0	0	0	1.5	1
16	7- 5-53	0	1	0	0	1	2
17	7-19-53	1	7	0	0	1.5	0.5
18	8- 2-53	0	9	0	0.5	0.5	0.5
19	8-16-53	0	9	0	0	0	1
20	8-30-53	0	4	0	0.5	0	0
21	9-13-53	1	5	0	0.5	1	0
22	9-27-53	0	2.5	0	0	2	0
23	10-11-53	0	0	0	0	2	0
24	10-25-53	1.5	0.5	0	2	0	0
25	11- 8-53	0.5	0	0	1.5	0	0
26	11-22-53	0	0	0	0.5	0	0

3.25 gm. per pound of mixture to obtain a level of 0.5 gm. per 100 pounds of body weight per animal per day average consumption. Consumption for the last half of the fourth month and all of the fifth month averaged 1.3 gm. per animal per day. Consumption in the sixth month dropped to 0.27 gm. per animal per day average. Phenothiazine-cottonseed meal-salt mix then was changed to 1 gm. phenothiazine per pound of mixture. This remained constant for the remainder of the experiment. Average phenothiazine consumption per animal per day gradually increased to a high of 1.6 gm. per animal per day, however, daily consumption varied and at no time throughout the experiment did this group reach 0.5 gm. per 100 lb. of body weight per animal per day intake (see tables 2 and 3).

Molasses consumption for group 6 was determined over a period of one week after which phenothiazine was incorporated at a ratio of 0.8 gm. per pound of molasses. Subsequently the ratio was increased to 1.5 gm., then to 3 gm. per pound, after which it was reduced to 1.5 gm. per pound. During this period consumption was erratic and unpredictable and definitely less in the higher phenothiazine concentrations. The addition of phenothiazine to molasses was an attempt to obtain 0.5 gm. phenothiazine consumption per 100 lb. of body weight per animal per day. This attempt was unsuccessful, and at the fifth month the phenothiazine in the molasses was reduced to 1 gm. per pound of molasses. Consumption at first was erratic; however, beginning the seventh month the intake gradually rose until the tenth month when the desired consumption of 0.5 gm. per animal per day was reached. This group was removed from phenothiazine at the 11th month and from molasses at the 12th month (see tables 2 and 3).

TABLE 7. Average Eggs of Cooperia Spp. / Gram of Feces / Animal / 14-Day Period

Period		Gp. 1	Gp. 2	Gp. 3	Gp. 4	Gp. 5	Gp. 6
	Initial	71	74	8	27	39	5.3
1	12- 6-52	34	8	14	16	87	116
2	12-21-52	47	98	7	58	225	131
3	1- 5-53	84	73	12	45	55	61
4	1-19-53	64	53	8	114	117	10
5	2- 1-53	53	12	14	165	154	2
6	2-14-53	7	8	4	33	174	5
7	3- 1-53	6	4	1	20	33	2
8	3-15-53	12	4	3	32	20	0.5
9	3-29-53	7	2	1	26	34	1.5
10	4-12-53	4	4	0	26	22	0
11	4-26-53	3	0.5	0.5	1	6	0
12	5-10-53	2	10	1	23	71	2
13	5-24-53	1	5	0	7	63	8.5
14	6- 7-53	0.5	5	0	12.5	11	1
15	6-20-53	0	2	0.5	35	28	1.5
16	7- 5-53	0.5	28	1	36	6.5	2
17	7-19-53	1.5	64	0	10	7.5	3
18	8- 2-53	0.5	21	0	10	2.5	3
19	8-16-53	1	34	1	3.5	5.5	2
20	8-30-53	1	54	0.5	4	1.5	1.5
21	9-13-53	0.5	5	0	2	4.5	2
22	9-27-53	0.5	1.5	0	4.5	2.5	1.5
23	10-11-53	0	4	0	10	3	2
24	10-25-53	1	3	0.5	20	2.5	0
25	11- 8-53	4.5	0	1.5	15.5	1	2
26	11-22-53	3	11	4	3.5	0	4

TABLE 8. Average Larvae of D. viviparus / 20 Grams of Feces / Animal / 14-Day Period

Period		Gp. 1	Gp. 2	Gp. 3	Gp. 4	Gp. 5	Gp. 6
	Initial	2	8	0	21	3.5	54.6
1	12- 6-52	12	8	76	92	12	441
2	12-21-52	15	—	163	37	338	79
3	1- 5-53	1	—	0.5	84	895	141
4	1-19-53	8	360	1	73	259	12
5	2- 1-53	1	222	2	15	66	1
6	2-14-53	0	22	0	105	53	5
7	3- 1-53	0	18	0	34	3	0.5
8	3-15-53	0	15	0	2.5	2	0.5
9	3-29-53	0	0	0	12	1	0
10	4-12-53	0	0	0	1.5	0	0.5
11	4-26-53	0	0	0	1	0	0
12	5-10-53	0	0	0	13	1	0
13	5-24-53	0	0	0	0	1	0
14	6- 7-53	1	0	0	4	0	0
15	6-20-53	0	3	0	0.5	0	0
16	7- 5-53	0	1	0.5	0	0	0
17	7-19-53	0	0	0	0	0	0
18	8- 2-53	0	0	0	0	0	0
19	8-16-53	0	0	0	0	0.5	0
20	8-30-53	0	0	0	0	0	0
21	9-13-53	1	0	0	0	0	0
22	9-27-53	0	0	0	0.5	0	1
23	10-11-53	—	—	—	—	—	—
24	10-25-53	—	—	—	—	—	—
25	11- 8-53	—	—	—	—	—	—
26	11-22-53	—	—	—	—	—	—

NOTE: Samples were not checked for *D. viviparus* on periods marked with "—".

Table 3 shows the total consumption (by groups) of salt, bone meal, red mineral, cottonseed meal, molasses, phenothiazine, and concentrates during the period of the experiment. Note that group 5 received cottonseed meal in addition to the regular concentrate mixture, whereas group 6 received molasses in addition. It is interesting to note that the consumption of salt and red mineral varied markedly among groups.

The average egg count per gram of feces per animal by groups of *H. contortus* and *O. radiatum* is given in table 4. Group 1 (controls) showed a gradual reduction for approximately six months, becoming virtually negative for the last half of the experiment. The egg count of group 2, however, after an initial drop following the therapeutic dose, remained con-

Group 6. Animals at the end of the 12-month experimental period. (Received two therapeutic doses of phenothiazine and then low level phenothiazine in molasses free-choice for ten months).

stant until the 13th period when it rose for a time and then gradually reduced in number to the end of the experiment. This rise in egg count can not be explained by the addition of the new animals as one original animal in the group exhibited a rise in egg count at the same time. Group 3 showed an immediate drop in egg count even though they did not receive a therapeutic dose. This reduction is attributed solely to low level phenothiazine intake. Even though group 4 received an initial therapeutic dose followed by low level phenothiazine intake in concentrates they did not show as an immediate or complete reduction in egg count as group 3. In groups 5 and 6, where the consumption of phenothiazine was erratic, the egg count reduction was not as marked or as complete.

Table 5 shows little if any value of low level phenothiazine in reducing average egg counts of *T. axei* and *O. ostertagi*. Group 3 egg counts, however, did reduce to zero. Group 6 on continuous phenothiazine shows a build-up of the egg count.

The infection of *B. phlebotomum* (see table 6) was low in all groups at the start of the experiment. Group 3 did not show eggs on fecal count after the ninth period. Group 6 carried infection to the 19th period and was negative thereafter. The two control groups and groups 4 and 5 showed very little change in the hookworm infection.

According to the data in table 7, low level phenothiazine has little if any effect on reduction of Cooperia egg counts. Table 8 shows that lungworms, *D. viviparus*, disappeared from the control groups at the same time as those groups on phenothiazine. Phenothiazine had no effect in reducing *Fasciola hepatica, Cotylophoron cotylophorum, Trichuris discolor*, Moniezia spp. or Strongyloides spp. during the period of this experiment.

The larvae culture data in fig. 1 indicates a sharp rise in larvae two weeks after removal from low level phenothiazine in groups 4 and 6 with a subsequent reduction. Groups 3 and 5, which remained on low level phenothiazine, maintained a low larvae count, whereas the control animals in groups 1 and 2 produced increasing numbers of larvae during the check period. It was noted that all animals in groups 1 and 2 were producing larvae. However, group 3 had only two animals producing larvae. One of these, the young, smaller animal placed with this group in the 12th period, was responsible for the majority of these. It was noted during the experiment that this animal did not feed regularly with the rest,

TABLE 9. Blood Analysis Averages / Animal / Group*

	Normal	Bleeding	Group 1	Group 2	Group 3	Group 4	Group 5	Group 6
Red Blood Cells	50-60 %	Nov. '52†	39.18	39.08	41.07	37.33	38.18	24.09
		Mar. '53	47.19	48.22	50.71	41.80	49.47	33.04
		July '53	52.41	51.14	47.59	50.36	55.14	35.20
		Nov. '53	58.97	55.85	57.11	56.60	60.43	42.51
Hemoglobin	10-12 gm.	Nov. '52†	10.0	8.7	10.4	9.7	9.0	6.7
		Mar. '53	12.0	10.1	10.3	10.2	11.3	7.7
		July '53	10.9	10.8	10.8	10.2	10.6	8.1
		Nov. '53	13.0	11.6	12.5	11.6	12.2	9.8
Calcium	9-12 mg./%	Nov. '52†	11.59	12.27	10.47	11.17	11.91	11.85
		Mar. '53	10.94	11.50	10.92	10.35	10.90	10.47
		July '53	11.42	11.80	12.38	12.31	11.37	11.16
		Nov. '53	10.86	9.43	9.69	10.24	8.03	9.18
Phosphorus	3-5 mg./%	Nov. '52†	5.18	5.76	5.68	5.92	6.16	5.65
		Mar. '53	5.60	5.17	5.89	5.76	5.81	5.90
		July '53	3.75	3.82	4.14	4.98	4.59	4.85
		Nov. '53	4.69	4.67	4.78	4.77	4.73	4.77

*Blood analyses were made by the Nutrition Laboratory, Department of Animal Husbandry, Agricultural Experiment Station, University of Florida.
†Initial analysis.

TABLE 10. Average Total Weights and Weight Gains in Pounds / Animal / Group / Four-Week Period

Gp.	Initial	1	2	3	4	5*	6	7	8	9	10	11	12	13	Final	Gain
1	264.1	1.0	6.4	10.8	32.3	22.8	19.2	35.5	15.8	40.0	27.5	14.8	26.3	42.7	504.1	240.0
2	234.6	-2.4	12.5	19.9	31.9	24.6	25.0	28.7	16.0	17.7	22.0	9.5	19.0	22.8	394.1	159.5
3	312.0	0.5	-8.0	18.0	12.1	28.1	29.3	28.8	34.8	29.8	41.0	27.3	23.2	8.7	523.2	211.2
4	264.1	-11.5	8.4	8.0	31.6	19.5	31.5	26.7	44.3	31.8	26.3	25.2	13.5**	22.2	494.1	230.0
5	245.5	9.4	12.8	14.8	26.9	20.6	20.0	26.2	40.3	23.5	22.7	24.5	27.7	11.8	431.0	185.5
6	205.1	-3.0	15.6	5.4	25.5	19.4	49.5	36.8	22.3	40.1	26.9	19.8***	30.3	-4.1	489.4	284.3

*All larger animals were removed from groups 1 through 5 at this time. Groups 1 and 4 remained at six animals each and group 6 at eight animals. Group 2 was reduced to three animals and three younger animals added. Group 3 was reduced to five animals and one younger animal added. Group 5 was reduced to four animals and two new animals were added.

**Group 4 removed from low level phenothiazine (last 30 days).

***Group 6 removed from low level phenothiazine (last 61 days) and molasses free choice (last 30 days).

being pushed aside at feeding time. Group 4 had three animals producing larvae in small numbers. However, when they were taken off phenothiazine, all six animals of this group began producing larvae in high numbers. In group 5, larvae were produced in low numbers in five of six animals. Production of larvae in group 6 was confined to four animals at the check period while on low level phenothiazine in molasses; however, as soon as these animals were removed from the medicated molasses there was a progressive increase in the number showing larvae until all eight animals were positive within a six-week period. One animal of group 6 was reluctant to consume the molasses-phenothiazine mixture during the experiment; this may account for the highest individual larvae count.

A progressive increase in the percent of red blood cells and grams of hemoglobin averages was noted in all groups throughout the experiment, however, these averages never reached the normal range in group 6 (see table 9).

Calcium and phosphorus levels in all groups showed a tendency to decrease, yet they remained within the normal range (see table 9).

When reviewing weight gains per animal per four-week period, it was noted that all groups required four to 12-weeks to attain reasonable gains (see table 10). This may be accounted for in the range cattle as they were unaccustomed to being handled, and in the dairy calves as they were heavily parasitized and weak at the start of the experiment. After the third period, all groups made equally good gains until the 13th period of the experiment when groups 3 and 5 revealed a marked reduction in average weight gains, whereas group 6 showed an average weight loss during this last period. It is interesting to note that groups 4 and 6 showed increased weight gains after removal from phenothiazine (see table 10). In considering the average total gains per animal per group throughout the experiment, group 1 (the controls) made the cheapest gains and graded out the best on slaughter. The animals of group 6 made the highest average gain; however, they were fed molasses in addition to the regular ration and had the lowest grade at slaughter. The animals in group 5 are considered to have made poor gains, especially since they received cottonseed meal in addition to the regular ration.

TABLE 11. Average Number of Adult Parasites, Nodular Lesions and Larvae Found on Postmortem at Time of Slaughter by Group*

	Flukes		Lung	Stomach			Small intestine				Large intestine					
Gp. No	F. hepatica	P. cervi	D. vivparus	H. contortus	O. ostertagi	T. axei	Coop. spp.	Strongy. spp.	Monieza spp.	B. phlebotomum	Nodules of O. radiatum	O. atum	Tric. discolor	Larvae	Setaria
1	0	0	0	4	1,600	8,033	175	0	0	5	185	9	0	500	0.5
2	0	3.5	0	534	0	1,950	5,150	0	0	8.5	245	150	0	650	0
3	12	12.5	0	0	0	0	0	0	0.5	0	255	0	0	100	0
4	6.5	3	0	303	600	16,150	1,500	0	0	1	47	0	0	200	0.5
5	0	0	0	18	1,300	4,300	900	0	0	2.5	85	0	0	900	0.5
6	0	0	0	273	1,466	16,533	1,466	0	0.3	0	350	9	0	900	1

*The viscera from two animals each from group 1 through 5, and three animals from group 6 were screened for parasites at slaughter.

This difference in grade and finish was apparent in the live animals.

The only animal that died while on the experiment was 28 from group 3. This animal progressively weakened and after 26 days was removed to a special pen for observation where it died on January 10, 1953. During the animal's presence in the experiment, it was noted that it did not feed regularly. The parasite findings on autopsy are shown in table 1.

Postmortem findings at time of slaughter show that the animals autopsied in group 3 were free of adult nematode parasites. It is interesting, however, to note that these animals were infected with flukes, tapeworms, and revealed a few parasitic nematode larvae. Groups 4 and 6, having had no access to phenothiazine for the last 30 and 61 days, respectively, were infected heavily with *T. axei* and quite high with *O. ostertagi* and *H. contortus*. Note that there were no *T. discolor, D. viviparus,* or Strongyloides spp. in any of the animals autopsied and also that the nodular worm, *O. radiatum,* had disappeared in the low level animals except those in group 6 which had been off the drug for 61 days. Hookworm infection was greater in the control groups (see table 11).

The results of the analysis of thyroids from representative animals for the iodine content are shown in table 12. It is apparent that animals on low level phenothiazine do retain a higher iodine content in their thyroids which remains higher than normal even though the anthelmintic is removed for a period of 30 to 61 days. We are unable to explain the high iodine content in the thyroid of animal 40 (group 2) except that this animal had received one therapeutic dose of phenothiazine NF green. Further experimental work is essential along this line to establish the role of the iodine impurities in NF green phenothiazine and the deposition in the thyroid tissues with consequent effects on the health of the animals.

TABLE 12. Iodine Content of the Thyroids of Experimental Animals at Time of Slaughter

Animal No.	Group† No.	Phenothiazine Therapeutic	Phenothiazine Low Level	Iodine[1] %
59	2	Yes	No	0.207
40	2	Yes	No	0.507
57	3	No	Yes	0.532
36	3	No	Yes	0.709
34	4	Yes	Yes*	0.790
44	6	Yes	Yes**	0.482
46	6	Yes	Yes**	0.270
47	6	Yes	Yes**	0.448
50	6	Yes	Yes**	0.484

[1]U.S.P. standard thyroid—0.17 to 0.23%.
*Off 30 days.
**Off 61 days.
†Due to an oversight at time of slaughter, thyroids from group 1 were not obtained.

During this experiment it was observed that a few animals in each group were naturally more greedy in feeding than others. Animal 36 of group 3 was one of these. From the beginning, this animal was the first at the feed trough and the last to leave; however, at the 12th weight period a weight loss was recorded while others in his group had gained. From that time this animal developed a rough haircoat, became sluggish and did not regain normal appetite. In an attempt to determine if any phenothiazine or its oxidation products were present in tissues, the spleen, kidneys and liver were analyzed with negative results.

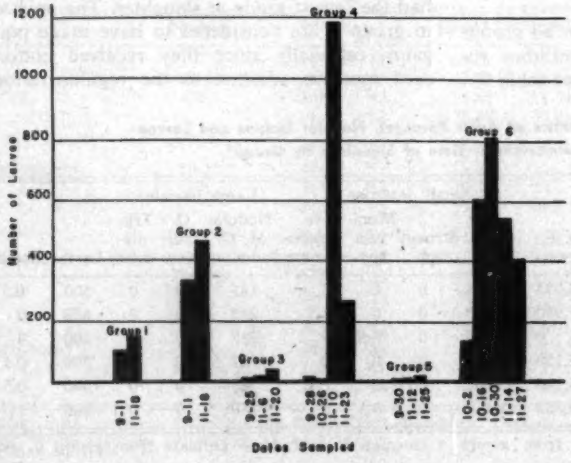

Fig. 1. Graph showing larval culture data for all groups. Group 6 was removed from low level phenothiazine on Oct. 2, 1953 and group 4 on October 26, 1953, whereas groups 3 and 5 remained on the medication during this period. Groups 1 and 2 were controls.

A total of 62.6 in. of rain fell during the period of the experiment with 36.2 in. falling between the 14th to the 22nd two-week period and a low of 1.87 in. falling during the fourth to the seventh two-week period. There were 279 days during the experiment when dew was present on the grass. The average mean temperature during the experiment was 70.4 F. with a mean low of 52.9 F. occurring during the second two-week period and a mean high of 82.9 F. during the 17th and 18th two-week periods. The climatic conditions during the experiment were normal for this area and ideal for parasite propagation.

Summary and Conclusions

In this experiment of one year duration, ordinary feeds such as ground, snapped corn, mixed dairy feeds, molasses base feeds, fed alone or mixed with citrus pulp, served as a good means of getting cattle to take the desired quantity of phenothiazine (0.5 gm. per 100 lb. of body weight per animal per day). Cottonseed meal and salt mixture (4 lb. cottonseed meal and 1 lb. salt) was a satisfactory vehicle as long as the phenothiazine did not exceed 1 gm. per pound of mixture. Even though the animals on this feed did not receive the desired level of anthelmintic, the larvae and egg counts indicated control using this level of medication. This evidence suggests that control of parasites may be effected by a lower level of phenothiazine than 0.5 gm. per 100 lb. of body weight per animal per day. Adequate intake in salt or in mineral mixes of various formulations for proper control of parasitism did not occur; consumption was erratic and unpredictable. Results of this experiment do not imply that minerals are not a good means of low level phenothiazine administration, even though several mineral mixes were tried. Further experiments on more palatable mineral-phenothiazine formulations are essential before proper free-choice intake with these vehicles can be established. Cane or citrus molasses were used as vehicles. One gram of phenothiazine to 1 lb. of molasses was found to be a satisfactory mix for low level intake. However, it was mixed for daily feeding; the stability of phenothiazine in molasses is unknown and further experimentation is essential with molasses before proper recommendations can be made.

It was found further that cattle did not consume the drug readily in feed or otherwise until ten days after the therapeutic dose. Apparently an interval of approximately ten days is required for cattle to recover from a developed dislike as a result of the therapeutic doses. There always will be a few animals that will not consume the phenothiazine low level mixes. These are the ones that are bullied by other animals, do not feel well, or are naturally shy about coming to the feed racks. Such animals should be placed in a smaller lot to insure the consumption provided. There also may be a small number of animals that will consume too much or be sensitive to the drug under low level administration. It was observed, that these latter individuals would develop a rough haircoat, be sluggish and have a poor appetite, and should be removed from this type of medication.

Low level phenothiazine did not have any effect on *D. viviparus, F. hepatica, C. cotylophorum, T. discolor,* Moniezia or Strongyloides spp. Its administration had little effect if any on Cooperia, *T. axei* or *O. ostertagi,* however, *H. contortus, O. radiatum* and *B. phlebotomum* were controlled effectively.

Low level phenothiazine did reduce pasture contamination by reducing parasite ova production and hatchability. However, as soon as the drug was removed, the number of larvae present in fecal samples increased rapidly.

In heavily parasitized animals, it is essential to give one or more therapeutic doses of phenothiazine prior to low level administration.

Group 1, the controls which received no phenothiazine, showed a higher weight gain with more finish than all other beef animal groups in the experiment.

The limited data obtained in this exepriment on the deposition of iodine in the thyroid shows a definite increase of iodine content in the thyroids of animals administered NF green phenothiazine.

The administration of low level phenothiazine in this experiment was not economical.

Further experimentation is essential to: (1) Develop more palatable mineral mixes as phenothiazine vehicles, (2) determine the stability and palatability of phenothiazine in molasses over an extended period, and (3) determine the role of iodine impurities in phenothiazine formulations and the effect on animals treated.

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(Continued on page 392)

Report On An Infectious Mastitis Control Program†

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THIS report is the summary of a mastitis control program, covering a period of over ten months (1953), in one dairy herd in northeastern Alabama. During this period various antibiotic ointments were used for the purpose of comparing their efficacy in the treatment of infectious mastitis. The preparations‡ used were: (1) Aureomycin crystalline ointment (60 mg. per gm.) in ¼ ounce teat tubes; (2) penicillin (100,000 units) and streptomycin (100 mg.) as an ointment and in 3.5 gm. teat tubes; (3) neomycin sulfate (200 mg.) and bacitracin (5,000 units); (4) neomycin sulfate (200 mg.), bacitracin (2,000 units), and penicillin G potassium (100,000 units); (5) neomycin sulfate (200 mg.) and penicillin G potassium (200,000 units); and (6) procaine penicillin G (100,000 units), dihydrostreptomycin sulfate (100 mg.), sulfamerazine (10% w/v), sulfathiazole (10% w/v). Numbers 3, 4, and 5 were supplied in 3.5 gm. teat tubes in a water-milk-miscible vehicle of 2% aluminum monostearate in peanut oil, and no. 6 was in peanut oil containing 3% w/v aluminum monostearate in 7.5 cc. teat tubes.

Milk samples were collected as aseptically as possible. All samples were streaked on blood agar (bovine blood). Staphylococci were checked for the ability to hemolyze blood, ferment manitol, coagulate plasma, and for pigment production. Some of the doubtful ones that did not fulfill all four of the above qualifications were streaked on Chapman Stone agar for further study.

Streptococci were identified according to their ability to ferment sugars and to hemolyze blood agar. In some instances, where there was known contamination, no attempt was made to identify the streptococcus.

The smears, from which the milk leucocyte counts were made, were stained with Newman's stain.

Table 1 shows the results of treatment with the various products used. Each cipher in the table represents either the treatment of all four quarters or the treatment of an individual quarter. The table is a summation of the treatment of 19 cows and over 77 quarters.

Taking the group as a whole, treatment was 70.2% successful. When only the neomycin preparations or only the bacitracin preparations are considered, treatment was successful in 100% of the affected quarters. It can be inferred from these data that neomycin and bacitracin udder ointment preparations have a definite place in the treatment of infectious mastitis.

At the start of the program, treatment was attempted with only one teat tube administered one time. As time went on, it was evident that attempts at a single treatment frequently were useless and the preferred method of treatment became the administration of one teat tube per affected quarter at 24 hour intervals for three successive days. Each infusion was followed by a five to ten minute massage of the treated quarter to insure more effective and extensive distribution of the ointment throughout the infected quarter.

One occurrence that caused some concern was the reappearance of a particular pathogen from one to several months after an apparent cure had been accomplished earlier. Questions that arose from this were these: 1. Will a nonhemolytic staphylococcus become hemolytic? If this should be the case then some of the "cures" recorded in this paper are false. 2. Is the reappearance of the same type organism several months after an apparent "cure" the same organism or a similar organism that has been introduced recently into the quarter? It is conceivable that an infection can be deep in a quarter and will shed organisms only periodically. 3. Is the appearance of a dif-

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‡With the exception of the aureomycin® teat tubes (Lederle) and the penicillin, dihydrostreptomycin, with sulfas (Bovicill-SS®; Pitman-Moore Co.) the teat tubes were furnished through the courtesy of The Upjohn Company, Kalamazoo, Mich.

ferent organism each month the result of deep infection and periodicity of shedding of organisms, does it indicate extremely poor husbandry, or is it a variation in method of sampling?

On several occasions when a composite sample gave a positive culture no treatment was given until quarter samples were taken. From this sampling practice it was found that pathogenic bacteria would disappear without treatment. These findings again raise the question of periodicity of shedding. Also, in the case of staphylococci, are contaminants from the surface of the udder being cultured? In any event, the complexity of handling infectious mastitis is only sharpened by findings such as these. Also, the difficulties in evaluating treatment become apparent.

In any event, these cases point out that routine dispensing of medicators or treatment of mastitis by the veterinarian without laboratory cultural tests certainly can result in false optimism about the amount of infectious mastitis in a dairy herd.

With regard to contaminants, all that seemed possible was done to collect samples aseptically. Sample vials used were those sent by the laboratory except on the few occasions when a scarcity of these tubes made the use of boiled, but clean, blood sample tubes a necessary procedure.

At no time was there any suspicion that the nonmastitic organisms cultured were the cause of trouble in this herd. For instance, the isolation of Pseudomonas sp. on three occasions, in different cases, was never associated with symptoms of mastitis. The appearance of coliform and spore-forming organisms was noticed particularly when there was a delay enroute of the samples. From these latter samples came the greatest amount of overgrowth. Contamination was most apparent in the samples collected in tubes that had been boiled in the office.

None of the so-called "barn tests" used in this program proved to be of much value in the diagnosis of infectious mastitis. The bromthymol blue cards were used 102 different times for a possible total of 408 quarters. During this period, 37 infectious mastitis cultures were made from 18 cows. There was a total of 44 infectious mastitis organisms identified. The cards reacted 18 times in 408 uses. (However, only 4 of the 18 reactions were accompanied with the isolation of infectious mastitis organisms.)

TABLE 1. Effect of Mastitis Treatment

Drug Used	RESULT	STAPHYLOCOCCUS INFECTION			MIXED INFECTION	STREPTOCOCCUS INFECTION		TOTAL	
		Non-hemolytic	Hemolytic	Aureus	Staph. & Strep.	Beta hemolytic	Agalactiae	No.	%
Neomycin and Penicillin*	RE	/	/**////		/		/	8	100
	NE								
Penicillin and Streptomycin	RE		/**/	/////	/			8	50
	NE		//	//////				8	50
Neomycin and Bacitracin	RE	/	/					2	100
	NE								
Neomycin, Bacitracin, and Penicillin	RE	/	///	///				7	100
	NE								
Penicillin, Streptomycin and, sulfas	RE								
	NE					/	/	2	100
Aureomycin	RE	/		////	/			6	66
	NE		/			/	/	3	33
TOTAL	RE	4(100%)	11(78.6%)	12(66.6%)	3(100%)		1(33%)	31	70.2
	NE		3(21.4%)	6(33.3%)		2(100%)	2(66%)	13	29.8

RE—Recovered: NE—no effect.
*Two cows treated with this product were noted to have a severe drop in production following treatment.
**Indicates one udder treated with two products before follow up culture was made.

Also to be considered is the effect on the cards of conditions causing a rise in the milk leucocyte count. There were seven quarters that showed an elevated milk leucocyte count but gave negative cultures. Of these, the brom-thymol blue cards indicated three for a percentage of 42.8.

Under the conditions these cards were used in this herd, there were 44 times that the cards could have indicated a positive reaction, whereas they reacted in only seven instances, or 15.9% of the time.

The strip cup was found to be of little value in the diagnosis of the great majority of cases of infectious mastitis. Generally speaking, the milk leucocyte count was of much more value in evaluating the seriousness of the condition present than any of the other supplementary tests used. Of 20 cultures of infectious mastitis organisms, the milk leucocyte count was evaluated in 17 (85%). Of 25 cultures of other than infectious mastitis organisms the milk leucocyte count was elevated in five (20%). Thus, it would seem that the milk leucocyte count is of definite advantage in evaluating the pathogenicity of infectious bacteria, and in determining the seriousness of injuries to the udder.

Insofar as infectious mastitis organisms are concerned, it is interesting to note that 76% of the herd, at one time or another, showed infection. The incidence of clinical mastitis, as shown by symptoms, was much less and was usually noted at time of freshening. Most of the positive cultures in this program were from cows that were asymptomatic. The object of the control program was to detect these early cases while treatment is still feasible, and before extensive udder damage is caused. From the data here presented, and experience with other herds, the authors are convinced that the preferred method of diagnosis, in the great majority of mastitis cases, is the cultural method.

Cultural procedure allows for more definite knowledge as to actual recovery from infectious mastitis. There should be no confusion of symptomatic recovery with actual recovery. The authors are of the opinion that without cultural procedures, a veterinarian is amiss if he attempts a mastitis control or treatment program in a dairy herd.

One thing of great importance is the education of the herdsman as to the purpose of the program and his central part in it. Observation of milking procedures at every opportunity, periodic plate counts taken on the dairy utensils by the local health department, and liason with the milk inspector are all aids to a successful program.

"The eye of the master fattens his cattle", holds as much truth today as when written in spite of mechanical gadgets designed to relieve the burden of feed handling for all classes of livestock.

▼ ▼ ▼

Atrophic rhinitis may be caused by a combination of diseases, such as a primary virus pneumonia or an upper respiratory disease of rickettsial origin followed by many secondary invading bacteria, protozoa, and fungi.—*H. C. Smith, D.V.M.*

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Toxicity tests on new phosphorus insecticides, malathion and chlorthion, reported by Bell *et al.* (*Jour. Am. Vet. Med. Assn.*, 126:302 [April], 1955) indicates that malathion, used either orally or applied as a dip, has a low toxicity for dogs. Chlorthion, however, proved to have relatively high toxicity and is considered unsafe for use as an insecticide dip.

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Feeding of Low-Level Phenothiazine

(Continued from page 389)

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Feeding Diethylstilbestrol To Cattle

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SINCE the U. S. Food and Drug Administration permitted the inclusion of stilbestrol in the feed of beef cattle being fed for the market last fall, interest in the use of this new method of stimulating gains in cattle has become widespread. Practicing veterinarians have an important role in this new development because of their close contact with livestockmen. Their advice and counsel can aid in the program by supplying accurate information as to the effects which the estrogens have and as to the results which may be expected.

I think it is well to point out first that in the use of stilbestrol or any other hormone miracles should not be expected. *Nothing can take the place of good feeding and management.* The proper use of hormones simply gives an added boost to well-fed animals. It makes it possible for the animal to utilize more of the nutrients fed for productive purposes.

This brings us to the question as to just what the feeding of stilbestrol does for the animal. I believe that the estrogens in low levels as recommended (about 10 mg./day for 800 to 1000 lb. animals) have a stimulating effect upon the animal's pituitary gland to secrete increased amounts of the growth hormone. *All animals need the growth hormone.* Animals which grow most rapidly under normal conditions are those which normally secrete larger amounts of growth hormone. The growth hormone enables animals to make more efficient use of the protein in the feed to build up bones and protein of the tissues. A larger percentage of the protein fed is retained by the animal.

Stilbestrol-feeding, then, stimulates the growth hormone to increased secretion and the latter then stimulates an increase in the growth rate. *It actually stimulates growth at the expense of fat deposition.* During the first month or two on stilbestrol, the growth rate is rapid and gains are large. After this period growth gains may slow down somewhat but the stimulus on the appetite is maintained and more of the feed is utilized for fattening rather than for protein gains.

The important point to understand is that stilbestrol-feeding primarily stimulates meat or protein growth and not fattening. Beef cattle have a natural tendency to fatten and, if adequate feed is provided, the increased stimulus for growth due to stilbestrol and fattening can go on simultaneously. However, if the feed is limited or of poor quality the growth stimulus will take precedence and the quality of the animals will suffer.

Another important factor in maintaining quality of cattle fed stilbestrol is the length of the feeding period. Since stilbestrol stimulates growth of animals, they will reach the weight which may be considered suitable for marketing in a shorter feeding period. However, they frequently will lack the finish which comes at the end of the normal fattening period. It is important, therefore, if quality is to be maintained, to feed as long as, or slightly longer, than normal. Packer-buyers should not be blamed for discriminating against stilbestrol-fed cattle if the cattle are short-fed and the condition desired is lacking.

In summary, the feeder should understand, that stilbestrol is primarily a growth stimulant and not a fattening stimulant. Increased rates of gain up to 30 or 40% have been reported. The quality of the animals fed stilbestrol is the responsibility of the feeder. Increased fat deposition requires time at the end of the feeding period.

Estrogen in the Tissue

The interest of the U. S. Food and Drug Administration is to guard the consumer of beef. Will the meat from stilbestrol-fed cattle contain residual estrogen which would be dangerous to the health and well-being of the consumer? I have just completed a series of studies to obtain further information on this problem. For this study, castrate mice were used as assay animals. When estrogen is given to such mice, even in extremely small amounts (4 to 8 parts per billion) there is a definite increase in the weight of the uterus. As a standard, stilbestrol was added to meat in increasing amounts and the average increase in uterine weight determined. Then samples of tissues of steers fed normal feed were compared with tissues from stilbestrol-fed steers. Some 21

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different tissues thus were assayed. These included all parts of the digestive tract, rumen-reticulum, omasum, abomasum, small intestine and large intestine, the glands and organs, including liver, kidney, heart, spleen, lungs, and brain, edible meat, ribeye, neck trimmings, and tongue, and finally depot fat from the kidney, caul, and cod. These assays uniformly revealed that the meat from stilbestrol-fed steers contained little or no estrogenic hormone. In other words, with an assay which can detect two to four parts per billion of hormone in the tissues, it was shown that it just is not present. Assays conducted at the Iowa and Purdue stations similarly show the absence of hormone in meat.

Our assays also show that tissues or packing house by-products which go into fur animal feeds are safe for use with such animals.

Estrogen in the Excreta

It is true that the urine and feces will contain some estrogen. Just how much is now under study. Female pigs following stilbestrol-fed cattle will show some stimulation of the vulva and mammary gland development. Little or nothing has been published on this problem. The writer has been informed that gilts bred a week to a month before following stilbestrol-fed steers have littered as many pigs as those following control steers. If these observations are confirmed, it would indicate that the low level of estrogen present in the feces will not interfere with pregnancy.

Male pigs and boars can tolerate large amounts of stilbestrol without interfering with semen production. Castrate pigs will not be affected.

Feeding Stilbestrol to Growing Dairy Cattle

Will the feeding of stilbestrol to dairy heifers and bulls be of value? Experimental evidence on this point is not yet available. The writer is of the opinion that it will stimulate the growth rate of dairy heifers just as it will stimulate the growth rate of beef animals. The amounts to feed in both beef and dairy heifers and bulls should be related to their body weights. I suggest that 1 mg./100 lb. body weight should be given. Thus a 300 lb. animal would receive 3 mg. per day, a 500 lb. animal 5 mg. and so forth.

Will heifers fed stilbestrol come in estrum normally? More experimental evidence is necessary, but preliminary observations indicate that they will and further that they will carry their calves as well as other heifers. The fertility of young bulls will not be affected by stilbestrol-feeding. All male animals producing male hormone are tolerant of the female sex hormone.

Feeding Stilbestrol to Lactating Dairy Cattle

In recent work in my laboratory, I have fed 10 mg. daily of stilbestrol to lactating cows after they start to decline in milk production. In every case the decline in milk production was stopped and in most cases there was a slight increase in production. This study was run only four weeks but it is suggestive that it will maintain the rate of milk production at a high level. Will the milk contain estrogen? Preliminary trials indicate that the milk is free of estrogen. More extensive trials are planned for the near future in order that the results may be submitted to the U. S. Food and Drug Administration for consideration.

Stilbestrol should not be fed to milking cows until it has been shown conclusively that it does not pass into the milk.

Use of Other Compounds Related to Stilbestrol

A number of other synthetic estrogens related to stilbestrol are available. Some of these probably will be more effective in cattle feeding; that is, smaller amounts per day will produce the same benefit. Of these, hexestrol and dienestrol have been tested by the Purdue station with good results. More about these will be heard during the coming months. They all act in the same way and the decision as to the best estrogen to use will depend upon the amounts required and the cost of production.

Other Animal Hormones

While stilbestrol feeding has captured the fancy of livestock men and has become popular, there are other hormones and products which are of great value and could be utilized by dairymen and beef producers.

For dairy cattle, a synthetic thyroprotein is available which will stimulate milk and fat production up to 20 to 30% when fed to milking cows after they start to decline.

Much is being learned about the role of the hormones in increasing the growth, reproduction, lactation, and fattening of live stock. This information will be utilized to a greater and greater extent in livestock production as time goes on. The scientific training and experience of the practicing veterinarian can aid in the development of these programs looking toward greater efficiency in livestock production.

Economic Poisons

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IN order to meet problems of economic poisoning, we collected a tabulation of them for our clinic. We feel that this tabulation may be of value to others and submit it herewith.

Inasmuch as prompt diagnosis is important and sometimes difficult, our list contains many of the common synonyms. Preparation labels do not always include one of these names, but usually give the chemical name of the poisonous substance. For that reason, those names are included also. The substances have been grouped for clinical purposes into four groups.

Group I

The group of poisons presented here have a common action, namely one of inactivating the cholinesterase of the body and thus freeing an excessive amount of acetylcholine. The overall effect of this group is to act as parasympathetic stimulants or to produce, to a large extent, the appearance of poisoning by muscarine. Depending on the dose of the poison and the substance acting, symptoms produced are vomiting and diarrhea, sweating, lacrimation and salivation, miosis, muscle twitching, and respiratory depression. Atropine is the classical antidote and should be given in a dose of 1 to 2 mg. hourly until 10 to 20 mg. have been given in a 24-hour period. Close attention should be given respiration and artificial respiration supplied if necessary. Changes in the fluid balance should be watched for and corrected. If the case is severe, venoclysis of blood or blood expanders are a must.

1. *Parathion* (diethyl-p-nitrophenyl thiophosphate).

Synonyms: Nitrostigmium,® alkron,® niran,® aphamite,® phoskil,® kilphos,® corothion,® paraphos,® genithion,® penphos,® mackothion,® vapophos,® plantthion,® thiophosk,® and others.

Formulation: Liquid or dust. (3 to 4%) made from concentrates of 25 to 95%.

Absorbed: By any route. This includes absorption through the skin. If spilled on the skin, it should be removed immediately by thorough washing with soap and water. It may be necessary for the person washing to be protected with rubber gloves.

Action: Inactivates cholinesterase. Poisoning may be acute or chronic.

Antidote: Atropine. 1 to 2 mg. per hour should be given to a dose of 10 to 20 mg. in 24 hours.

2. *Tetraethyl pyrophosphate.*

Synonym: TEPP.

Formulation: Field use emulsions and dusts of 0.025 to 1.15%. Made from concentrates of 50% or more.

Absorbed: By all routes.

Action: Inactivates cholinesterase.

Antidote: Atropine. Same dose as above.

3. *Systox* (diethoxythiophosphoric ester of 2-ethylmercaptoethanol).

Synonym: E-1059.

Formulation: Comes as wettable powder, dusts and systox on carbon in varying strengths. Made from concentrates of as much as 50%.

Absorption: By all routes. (Note, it moves from one part of a plant to all parts.)

Action: Inactivates cholinesterase.

Antidote: Atropine. Same dose as above.

4. *Malathion* (O, O-dimethyl dithiophosphate of diethyl mercaptosuccinate).

Formulation: Liquid or dust.

Absorbed: By any route.

Action: Inactivates cholinesterase.

Antidote: Atropine. Dose the same as above.

5. *Hexaethyl Tetraphosphate.*

Synonyms: HETP, hexastigmium®.

Formulation: Liquid or dust.

Absorption: By any route.

Action: Inactivates cholinesterase.

Antidote: Atropine. Same dose as above.

6. *DFP* (Diisopropyl fluorophosphate).

Formulation: Liquid or dust.

Absorption: By any route.

Action: Inactivates cholinesterase.

Antidote: Atropine. Dose same as above.

Group II

The members of the second group of economic poisons given here are all halogenated organic compounds. The symptoms and treatment of each of these substances is much the same; the distinctive symptom being central nervous system stimulation often with convulsions followed by depression and collapse. Vomiting often occurs but may be absent. A stomach suspected of ingestion of any of these substances should be washed out thoroughly and a cathartic administered subsequently. Oily cathartics should be avoided because they promote absorption. Convulsions (CNS) stimulation should be treated with a short acting barbiturate, pentobarbital being considered the best of the group. Other barbiturates may be used if pentobarbital is not available. The barbiturate dosage may be considerably larger than a normal dose when used to combat overstimulation caused by these poisons. The depressant stage of the poisoning is treated by stimulants and general supportive measures. Calcium gluconate has been found to be of value plus carbohydrates and vitamins as follow up treatment to protect the liver, which is particularly susceptible to this type of poisoning. Pulmonary edema may be prevented or treated by proper drainage and oxygen inhalation. Morphine is contraindicated.

1. *Aldrin* (1,2,3,4,10,10,-hexachloro-1,4,4a,-5,8,8a,-hexahydro-1,4,5,8, - dimethano-napthalene).

Synonyms: Octalene,® compound 118®.

Formulation: Liquid or dust.

Absorption: By any route. Especially mouth, lungs, and skin.

Action: CNS stimulation with excitation, hyperirritability, loss of equilibrium, clonic-tonic convulsions and later depression. May be pulmonary edema and vascular collapse.

Antidote: Remove poison by lavage and give pentobarbital (to combat stimulation) and calcium gluconate.

2. *Gamma Benzene Hexachloride* (gamma isomer 1,2,3,4,5,6,-hexachlorocyclohexane).

Symptoms: BHC, GBH, HCCH, HCH, lindane,® 666,® gammexane,® benzahex,® chemhex,® gamoxo,® gamtox,® hexadow,® isotox,® lexone,® gexane,® kwell,® neoscabicidol,® sarcoptan,® hexicidum,® gamma BHC, hexacide®.

Formulation: Liquid or dust.

Toxicological consideration: Same as above.

3. *Chlorophenothane* (2,2,bis - [p - chloro - phenyl]-1,1,1-trichlorothane).

Synonyms: Gessarol,® neocid,® dicophane,® DDT, dichlorodiphenyltrichloroethane.

Formulation: Wettable powders, emulsions and dusts having a concentration of varying strengths ranging up to 35%. Many formulations contain other insecticides, which should be taken into consideration when poisoning occurs. Such solvents as kerosene are also poisonous and must be considered when prescribing treatment.

Toxicological considerations: The same as above.

4. *Chlordan* (1,2,4,5,6,7,8-octachloro-3a,4,7,7a-tetrahydro 4, 7-methanoindane). Technical grades contain alpha and beta isomers also.

Synonyms: Chlordane, octa-klor,® velsicol 1068®.

Formulation: Solutions, emulsifiable concentrates, wettable powders, and dusts.

Toxicological considerations: The same as above.

5. *Dieldrin* (1,2,3,4,10,10-hexachloro - 6,7-epoxy - 1,4,4a,5,6,7,8,8a - octahydro - 1,4,5,8-dimethano-naphthalene).

Synonyms: Compound 497,® octalox®.

Formulation: Concentrated solutions, emulsions, wettable powders and dusts.

Toxicological considerations: The same as above.

6. *Dilan* (mixture of 2-nitro-1, 1-bis-[p-chlorophenyl] propane [one part] plus 2-nitro-1, 1-bis [p-chlorophenyl] butane [2 parts]).

Synonyms: Prolan-bulan mixture.

Formulation: Emulsifiable concentrate, wettable powder, 50% dust concentrate.

Toxicological considerations are essentially as for other members of this group, but experience and knowledge of these materials is limited.

7. *Toxaphene* (chlorinated camphene).

Synonyms: Chlorinated camphene, compound 3956,® phenatox,® penphene,® gyphene,® terpene,® phenacide,® toxakil,® kilphene,® chlorphene,® alltox®.

Formulation: 5, 15, 20 and 40% dust, 40% wettable powder, 42 to 73% emulsifiable concentrate, 44 to 80% concentrates in oil, 5% bran bait and a cotton dusting formula with 20% toxaphene.

Toxicological considerations: The same as given for one above.

8. *Methoxychlor* (1,1,1-trichlor-2,2-bis-[p-methoxyphenyl] ethane).

Synonyms: Marlate,® DMDt®.

Formulation: Powder and liquid.

Toxicological considerations: The same as those given above.

Group III

The group of poisons to be discussed here cannot be classified together either chemically or toxicologically and are thus discussed individually.

1. *Warfarin* (3 - [a-acetonyl-benzyl] - 4 - hydroxycoumarin). Rat poison.

Synonyms: WARF-42,® dethmor,® rat-death,® ro-deth®.

Formulation: Supplied as a 0.5% powder diluted with corn starch for making baits, or commercial baits are sold containing 0.025% or less of warfarin.

Absorption: Usually by the oral route.

Action: Inhibition of prothrombin formation and capillary damage. Slightest trauma produces bleeding and the clotting power of the blood is reduced. Large doses produce maximum damage in about five days with recovery in 10 to 11 days. Smaller doses act more quickly with a quicker recovery time.

Antidote: Specific antidote is vitamin K and blood transfusions. If the poisoning is discovered soon enough, it should be removed by gastric lavage.

2. *Antu* (alpha naphthylthiourea). Rat poison.

Formulation: Supplied as the gray powder which is to be mixed with baits and made accessible to rats.

Action: This substance is very insoluble but highly toxic to rats when ingested. It kills by producing a drowning edema of the lungs. It produces emesis in dogs and is thus not apt to be fatal to them.

Antidote: No specific antidote to this poison has been developed but its high degree of insolubility makes it easily removable from the stomach following ingestion. If edema develops, it should be treated with oxygen inhalations and by withholding all fluids until it subsides.

3. *Sodium Fluoroacetate* (sodium monofluoroacetate). Rat poison.

Synonyms: 1080, ten eighty sodium monofluoroacetate.

Formulation: Colorless, odorless, tasteless water-soluble salt. It is most effective against rats as a water solution in a 1 to 300 strength. It also may be mixed with common rat baits in a strength of about an ounce of poison to 28 lb. of bait.

Absorption: Is usually by the oral route. Dust may be absorbed through the pulmonary system.

Action: This substance is very soluble and is quickly absorbed. It is highly toxic to all mammals. Its principal action seems to be against the heart by inhibition of oxidative metabolism. Death occurs from cardiac failure. The central nervous system may be attacked producing convulsive seizures followed by severe depression, or in milder cases, clonic muscular spasticity resembling mild strychnine toxicity. There may be a latent period before symptoms appear of between 30 minutes to two hours or longer.

Antidote: No specific antidote has been developed for this poison. Treatment is mainly symptomatic. Immediate emesis and gastric lavage with oral dose of magnesium sulfate are useful. A combination of sodium acetate and ethanol (2 gm./kg. of each) has been found to be helpful. Magnesium sulfate in a single dose of 800 mg./kg. given intramuscularly as a 50% solution has also proved helpful to prevent clonic spasms by mild sedation.

4. *Allethrin* (allyl homologue of cinerin I). Insecticide.

Synonyms: Cinerin 1, pyresyn®.

Formulation: Usually placed in some solvent to be used as a spray, but occasionally may be marketed as the powder in high dilution.

Action: It has been stated authoritatively that natural pyrethrins are among the safest insecticides available. This is true even in the presence of the activators, piperonyl butoxide, n-propyl i-some and MKG 264. Allethrin is in the same category toxicologically, as the natural pyrethrins.

Antidote: No specific antidote is used here and probably is not necessary. In cases of ingestion of either of the above agents, they should be removed by emesis. In addition, it is very important to determine whether or not other lethal agents were present with the above substances as a mixture. It is also important to consider the type of solvent that may be present. If the insecticide is in the powder form and not mixed with other lethal agents, it can not be considered highly toxic except in large amounts or in concentrated form. If insecticide is dissolved in such solvents as kerosene, benzene, gasolene, xylol, or similar substances, serious poisoning may result from the solvent and should be treated largely from that standpoint.

5. *Butopyronoxyl* (3,4-dihydro-2,2-dimethyl-4-oxol, 2H-pyran-6-carboxylic acid butyl ester). Insect repellent.

Synonyms: Butyl mesityl oxide, indalone®.

Ethohexadiol (2-ethylhexane-1,3-diol). Insect repellent.

Synonyms: 612,® Rutgers 612®.

Dimethyl Phalate (a,a-dimethyl-a-carbutoxy-a-pyrone). Insect repellent.

Synonyms: none.

Dimethyl Carbate (dimethyl ester of cis-bicyclo [2.2.1 - 5 - heptene - 2, 3 - dicarboxylic acid]). Insect repellent.

Synonyms: none.

Formulation: All the above named four insect repellents are usually marketed in mixtures in various solvents.

Action: They are for external use and are considered safe as skin repellents for flies, fleas, et cetera. They all possess the property of producing local irritation if applied to thin skinned areas or near or on mucous membranes. They are poisonous if ingested. Upon swallowing, there will be irritation of mouth, throat, and stomach. Liver and kidney damage are apt to occur with edema of the lungs.

Antidote: No specific antidote has been developed for these materials. Treatment should consist of removal of the poison followed by protection of the liver and kidney. Oxygen inhalations would be useful for the pulmonary edema. It is well to remember that the solvent may be very poisonous and may require treatment.

6. *Isobornyl Thiocyanoacetate*. Pediculicide.

Synonym: Thanite®.

Formulation: Is applied as a ten minute application externally in a 5% concentration.

Action: If kept away from the eyes and mucous membranes, very few cases of skin irritation occur. When accidentally ingested, it acts mainly as a liver poison. It is considered about one-fourth as poisonous as DDT.

Antidote: There is no specific antidote for this substance. If ingested, it should be removed in the usual way. The liver should be protected against its specific action. Solvent poisoning should be considered also.

Group IV

Solvents. From the above discussion, it is to be seen that the presence of various solvents becomes a factor in the toxicology of many toxic agents. When poisoning occurs and a solvent is also present, it must always be taken into consideration. The common solvents used are kerosene, gasoline, benzene, xylol, light petroleum oil, and others. The label of any poison should state what solvent is used.

Since kerosene is the most common solvent for most of the commercial poisons in general use, its toxicology is considered here. Some of the synonyms for kerosene are coal oil, deobase, and paraffin oil.

Absorption may occur orally or through the respiratory tract. After absorption, there may be or not an excitement phase followed by a marked depression. When death occurs, it is usually due to aspiration of small amounts of the oil into the lungs. Pneumonia is frequently observed following poisoning. Recovery has followed large amounts of this substance orally and death frequently occurs following the aspiration of very small amounts. Liver and kidney damage occur frequently.

For treatment of ingested poisons in the past, large amounts of mineral oil have been used via stomach tube. The U. S. Public Health Service warns that no oil laxative of any kind should be used. Also, emetics are dangerous because of the chance of aspiration of the poison into the lungs. Protect the liver and kidney, coat gastric lining with emulsents and absorbents and administer symptomatic treatment.

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Parakeratosis in Swine

A swine dermatitis designated parakeratosis recently has been mentioned rather frequently in professional literature. The condition is characterized by a reddish discoloration in the areas of the ears, tail and feet. Later the entire skin becomes thickened, and cracks form; the joints may be so painful that the animal can be made to move only with difficulty. Death may result; those that recover remain stunted. Salmon and Tucker of the Alabama Polytechnic Institute thought the condition could be a nutritional disturbance, and directed their researches on this basis. Now they are able to announce that the dermatitis investigated by them was a zinc deficiency. In order to prevent the trouble in hogs on dry feed, they recommend 0.2 lb. of zinc carbonate in each ton of feed. If the disease is already present, increase the dosage to 0.4 lb. of the zinc salt per ton. Changing the hogs from a dry corn-vegetable protein ration to lush pasture also hastened recovery. Otherwise, without a change in the ration, recovery soon took place with the added zinc.

Virulent Foreign Newcastle Disease In Partridges

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AN unique characteristic of Newcastle disease (ND) is the widely varying virulence, which isolations of the virus from different parts of the world have for domestic fowl. In some countries, this disease is extremely lethal for poultry. By contrast, the disease which occurs in the United States is usually moderate in virulence. Hemorrhages are a prominent pathological feature in virulent foreign outbreaks, whereas discernible lesions are seldom observed at postmortem examination of naturally-occurring cases of the disease in this country. In virulent outbreaks in foreign countries, mortality often reaches 100% in poultry flocks of all ages. In this country, however, losses vary with the age of the affected birds. Deaths probably average 30% in broiler plants and 10% in mature flocks.

This report concerns findings relative to the isolation of a highly virulent strain of ND virus from a shipment of partridges (*Perdix perdix*) from Spain to the United States. The disease was diagnosed during the required quarantine of the birds at the U. S. Department of Agriculture, Animal Inspection and Quarantine Station, Port of New York.

History

The shipment consisted of 160 mature partridges imported by air from Madrid into the United States under permit. At the time of arrival at the quarantine station, where they were subjected to the minimum 15-day quarantine, 20 birds were dead. A considerable number of deaths occurred daily thereafter. Since captivity frequently causes heavy losses of feral birds, it was difficult to determine whether the deaths were caused by infectious disease or by failure of the birds to adjust to their new environment and to feeding in confinement. When infectious disease was suspected in this shipment, eight birds that had just died were refrigerated with a few pounds of dry ice and were air-expressed to the Animal Disease and Parasite Branch Laboratories, Washington, D. C., for examination. The time elapsing from collection until receipt at the laboratories was approximately 3½ hours. When received, the birds were so solidly frozen that overnight defrosting in the refrigerator was necessary before the autopsies could be performed.

Diagnosis

The most significant findings at autopsy were tiny white foci visible through the wall of the intestine and present throughout the length of the small intestines in several of the birds. Histologically these proved to be small ulcers. Cultures of the intestinal contents were negative for Salmonella organisms and microscopic examination of smears were negative for coccidia. Cultures on blood agar were made from the liver of each bird, with negative results.

A composite specimen consisting of one lung, a piece of liver, and the spleen from each bird was collected for virus isolation in chicken embryos. This specimen was pre-

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Fig. 1. Subserous petechia in the peri-proventricular fat of a hen.

pared, as described in a previous paper[3], by triturating in a mortar with pestle and sterile 90-mesh alundum, suspending in sterile nutrient broth, centrifuging, treating the supernatent with streptomycin, and then injecting into ten-day-old embryonated hens' eggs.

The embryos inoculated with this material died the second day post inoculation. Stained smears of the extra-embryonic fluids, as well as cultures in nutrient broth, were negative for bacteria. Hemaglutination[4] could be produced in dilutions of these fluids up through 1:1280, and it was inhibited by ND antiserum. To further confirm the diagnosis of ND, a serum-neutralization test was performed in embryonated hens' eggs according to the procedure[5] of the Bureau of Animal Industry. In this test the virus had a 50% lethal dose titer of slightly more than $10^9 ld_{50}$/cc. Approximately 1,000,000 ld_{50} were neutralized by ND antiserum.

By this time less than 40 partridges remained alive. Nervous manifestations typical of the sequela commonly associated with ND were observed in a few of the birds. These remaining partridges were destroyed at the quarantine station.

Pathogenicity for Chickens

During the recording of the embryo mortality, it was noted that nearly all of the embryo deaths, even in the high dilutions of virus, occurred the second day after inoculation. This observation, together with the information that only about 40 partridges remained alive at the time the diagnosis was reported, suggested that the isolation might have highly lethal qualities for domestic poultry.

To determine the virulence of this isolation for chickens, 0.1 ml. of a 1:10,000 dilution of infected egg fluids was administered intramuscularly to a group of 28 eight-week-old chickens and another group of 20 hens. All of the chickens and 19 hens died on the fourth and fifth days post inoculation. The remaining hen died the seventh day after experimental exposure. These results confirmed the suspicion that this virus was extremely virulent.

Postmortem Findings in Chickens

Hemorrhagic lesions characterized autopsy findings in the chickens. These consisted of petechia in the abdominal fat (fig. 1) and submucosal hemorrhages in the intestines and proventriculus (fig. 2 and 3). In the intestines these lesions varied from small to large hemorrhages. Sloughing of the mucous membrane occurred in the larger lesions. In some cases (fig. 4) diphtheritic patches were formed. A characteristic location for one of the large lesions was the section of ileum between the heads of the ceca. The cecal tonsils were generally hemorrhagic and enlarged.

Hemorrhagic lesions were observed in 26 of the 28 young birds. They were distributed as follows: Submucosal hemorrhages throughout the intestines, 13 birds; hemorrhages in the mucosa of the proventriculus, 16 birds; the lesion in the portion of ileum between cephalad parts of the ceca, 19 birds; petechia on the serous membranes, nine birds.

Of the 19 hens autopsied, ten had submucosal hemorrhages extending throughout the intestines, 15 had the lesion in the mucosa of the portion of ileum between the ceca, and all had subserous petechia in the abdominal fat.

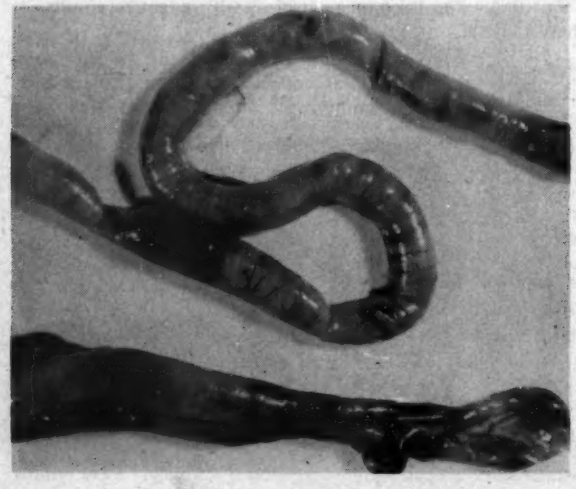

Fig. 2. Submucosal hemorrhages in the intestines. Several plaques of the diphtheritic-hemorrhagic lesion may be seen. One extensive area is in the ileum between the ceca. The cecal tonsils are hemorrhagic.

Immunological Identity

To determine whether this partridge strain of ND virus varied from the immunological type of ND which exists in the United States, 30 33-day-old chickens were vaccinated by administering intramuscularly 0.1 ml. of a 1:10,000 dilution of a laboratory culture (allantoic fluid) of a wing-web vaccine strain of ND virus. The birds were challenged by the same route and with a similar dosage of the

Fig. 3. Hemorrhage in the mucous membrane of the proventriculus at the junction with the gizzard.

partridge virus 15 days later. No mortality occurred, but two birds developed nervous symptoms of ND seven days after challenge. Since the period between vaccination and challenge was short and nervousness developed soon after challenge, it is considered likely that the symptoms actually existed as a result of vaccination and were accentuated by challenge rather than by failure of the vaccine to immunize against the challenge virus.

The results of this experiment are interpreted as indicating that no immunological variation of the partridge virus from ND as it occurs in this country existed.

Discussion

This study augments previous observations that in other countries strains of ND exist which are much more virulent for domestic poultry than any which occur naturally in this country. It illustrates that virulent foreign strains of Newcastle disease would be capable of causing great losses should they gain entrance to our poultry farms. It reiterates that species other than poultry might be the source of such an introduction.

The first experience[4,5] of an introduction of a virulent foreign ND into the United States was in 1950 when the disease was introduced in an air shipment of pheasants, partridges, quail, and ducks from Hong Kong, China. In this instance, species other than domestic poultry were the source of introduction. This outbreak caused in excess of 95% mortality in the chickens of the flock of the importer. It was eradicated immediately by destroying all poultry and ornamental birds on the infected and exposed farms. Because of the geographical area of origin, together with its outstanding virulence, this lethal type was recorded as Asiatic ND. A distinguishing feature at postmortem examination of the infected birds was hemorrhages on the mucous membranes of the proventriculus and intestines.

Of the studies made in this country relative to foreign strains of ND virus, Jungherr *et al.*[6] were the first to point out the great variability in the manifestations of ND from the inherent differences in pathogenicity. Their experience with four European and five North American strains was that hemorrhages were more prominent and present with greater regularity in infection with the European strains and rarely observed with the American strains. They cite related observations of several investigations abroad.

Subsequently, in a study of a highly virulent strain of ND virus from Mexico, Thompson and Osteen[7] found that it was characterized at autopsy by hemorrhagic lesions in the mucosa of the proventriculus and intestines. The virulence of this strain is illustrated by the fact

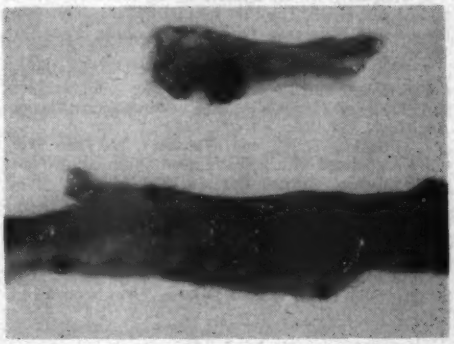

Fig. 4. Intestine opened to show circumscribed hemorrhages and a diphtheritic patch.

that it produced acute deaths in 87% of 128 mature fowl. Paralysis occurred in an additional 6%. Thus, the probable mortality approached 95%.

It might properly be mentioned that three reports[8,9,10] have been published concerning natural outbreaks of ND in the United States where exceptionally high mortality occurred. In none of these, however, did the mortality

approach the 95% figure and in none were hemorrhagic lesions a significant feature.

In view of the evidence provided in the aforementioned experiences and the case herein described, continuous alertness against possible introduction of such exotic strains of ND into this country is fully warranted. Federal regulatory programs of this country reflect awareness of this hazard.

Summary

This paper concerns the isolation of a highly virulent strain of Newcastle disease virus from an importation of partridges from Spain. Findings relative to the virulence for domestic poultry, postmortem lesions, and immunological identity are reported. The variation in virulence of Newcastle disease and its regulatory significance is discussed.

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Effectiveness of frozen semen in cattle breeding may depend on the experience of the technician in charge. Where technicians lack experience, frozen semen is giving lower conception rates than fresh supplies.

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Listeriosis is perhaps world-wide in distribution and almost any warm blooded animal may be expected to harbor organisms.—*Carl Olson, Jr., D.V.M.*

New Instrument Measures Live Animal Back Fat Accurately

Unique and new on the market is the Lean Meter, now in production by the Duncan Electric Manufacturing Co., Lafayette, Ind. The instrument, developed by Drs. R. M. Whaley and F. N. Andrews of Purdue University, is designed to measure, within one-tenth of an inch, the back fat on either live animals or carcasses.

One of the developers of the Lean Meter, Dr. F. N. Andrews of Purdue University, demonstrates its method of use.

A thin, needle-like probe is pressed through the skin and into the fat and muscle tissues. The variance in the electrical conductivity of the tissues is shown on an indicator, telling the operator when the probe passes from fat into muscle tissue. The depth of the probe is then read on the measurement scale. Another scale may be used when grading market hogs to determine if fat thickness is less than an amount preset on the scale.

The Lean Meter has been designed to increase the accuracy of live animal grading and speed up the production of meat-type hogs. Advantages are claimed for breeders, producers, packers, and research scientists.

The Use Of Cortisone In Small Animal Practice†

L. R. KARMIN, D.V.M., Bellerose, N. Y.

THERE is little doubt that the discovery, synthesis, and production of cortisone and related corticoid hormones is one of the great advances in medicine. The studies describing the various phases of development and rationale of these drugs have been reported fully in other publications. Nevertheless, many veterinarians have failed to utilize their advantages and unique properties. This paper describes the application of cortisone and related preparations to particular problems in small animal medicine. They are familiar to all practitioners who treat pets extensively, and are notable chiefly for their troublesome nature. The case reports are grouped into several general classifications according to the principal symptoms or site of the disorder.

Ophthalmology

Numerous cases of keratitis, ulcerative keratitis, and panophthalmia of either infectious or traumatic origin have been treated with excellent results. Treatment consisted of instillation of a 0.5 to 2.5% cortisone acetate suspension in physiological salt solution into the eye, 1 drop every three to six hours. An antibiotic ointment may be used at the same time whenever indicated. Excellent results were obtained in practically all cases. A noticeably shortened healing time as compared to previous methods of treatment was evident.

Case 1. A 1½-year-old St. Bernard bitch was presented for examination on March 11, 1951. The dog had been rubbing the eyes for two weeks. A copious yellow purulent discharge was present, the owner stating it was impossible to keep the eyes free from it. Examination revealed bilateral ophthalmia, grossly thickened nictitating membranes and ulceration of both corneas combined with a fleshy, granulomatous pannus. Photophobia and greatly impaired vision were also present. Treatment with antibiotics for two weeks prior to the first examination was unsuccessful with the condition becoming rapidly worse. The dog was hospitalized and cortisone therapy instituted. After 1 drop of a 0.5% cortisone acetate solution had been instilled into the eye eight times at three hour intervals, irritation had subsided. Treatment then was continued with 1 drop in each eye every four hours and finally four times a day. By the end of one week, the conjunctiva took on a more normal appearance and the pannus receded. When the treatment was stopped after a total of three weeks, the eyes had regained normal sight. Two weeks later, small areas of scar tissue on the cornea were the only visible lesions.

Case 2. A 14-year-old male Boston Terrier was presented for examination with a history of a discharge from the right eye, photophobia, and having held the lids tightly closed for the previous two weeks. Home remedies had failed. The fluorescein test revealed an ulcer encompassing nine tenths of the cornea. A small blister in the center of the crater indicated imminent rupture of the cornea. The animal was hospitalized and the lids sutured together to prevent self-mutilation. A 2.5% cortisone acetate solution was instilled into

†A number of the experimental formulations of cortisone and hydrocortisone mentioned in this paper were supplied through the courtesy of Merck & Co., Inc., Rahway, N. J.

the eye, 1 drop every four hours for 24 hours, then 1 drop four times a day. At removal of the sutures after five days, the eye had improved greatly. Treatment was continued for 12 more days. At the time of discharge, fluorescein failed to stain the cornea.

Rheumatism and Joint Diseases

The dramatic response of human arthritis to cortisone has been reflected, similarly, in canine rheumatoid conditions. The rapid relief from pain with few relapses following withdrawal of the drug, and absence of serious side effects make cortisone the drug of choice in this group of conditions. Routine treatment consisted of parenteral administration of 1 to 5 mg. cortisone acetate per lb. of body weight, accompanied by salicylates, analgesics, and local application of heat when necessary.

Case 1. A mongrel terrier, previously treated for a "rheumatic condition", was brought to the hospital. The dog was in severe pain and unable to rest. The right elbow was swollen. A roentgenogram was taken and a diagnosis of rheumatoid arthritis was made. Intramuscular injections of 60 mg. of cortone® acetate each on three consecutive days, beginning on February 3, 1952, resulted in considerable improvement of the swelling, but the dog was still unable to use the leg. Intramuscular injections of 35 mg. cortisone were given on each of the four following days with the result that the dog was walking normally by February 9. The swelling had subsided completely with no evidence of pain on manipulation of the joint. On February 11, 25 mg. cortisone was injected intramuscularly and a final injection of 15 mg. was given on February 13. On December 24, 1952, the swelling and symptoms returned. Cortisone injections were again given at the rate of 60 mg. the first day, 35 mg. on the two following days, 25 mg. the next two days and 15 mg. the last day. With the third injection all symptoms had receded and have not returned to date.

Case 2. A five-year-old Cocker Spaniel bitch was presented with a history of whining and inability to bend the neck forward to reach for food or water. Raising or lowering the head caused severe pain. A diagnosis of cervical arthritis was made. A rapid response was obtained from a single intramuscular injection of 50 mg. cortisone. That same evening the dog was resting comfortably and could reach the food bowl with little pain. After two more injections at 24-hour intervals treatment was discontinued as symptoms had disappeared entirely.

Case 3. An eight-year-old Cocker Spaniel bitch, unable to rest or sleep for three days had, by her whining and crying, kept the family up the previous two nights. Examination failed to reveal any specific area of sensitivity, but rather a generalized hyperesthesia. Extreme pain was induced in certain groups of muscles when flexed or extended. A diagnosis of rheumatism was made and cortisone administered intramuscularly at the rate of 50 mg. daily for three successive days. Phenobarbital in doses of 15 mg. was given three times daily. The dog had a restful night following the first injection and was completely normal after 48 hours.

The so-called posterior paralysis complex is complicated not only by the occasionally obscure prodromal symptoms but also by the lack of clear-cut diagnostic procedures. It is known that many conditions will cause similar clinical pictures. I have tried by the use of *x*-rays, blood and urine examination, history checks and careful evaluation of symptoms to separate these cases into certain groups:

1. Those showing calcification, ruptured or "slipped" discs, or other physical defects in the spinal column.

2. Those with a history of recent severe, acute infection.

3. Traumatic cases.

4. Those with sudden onset falling into neither of the above groups, or preceded by rather mild symptoms. These cases I have assumed to be caused by a neurotrophic etiological agent, either viral or bacterial.

Cortisone treatment of cases in the above categories has produced the following results:

(1) Improved comfort of the animal by relieving pain, but without correcting the primary condition.

(2) Apparently no alteration of the course of the primary disease or material aid in secondary neurogenic complications.

(3) Relief from pain and more rapid response to corrective measures and shock treatment in traumatic cases.

(4) Greatest response obtained in acute infectious diseases.

It is my opinion that an epizootic caused by a neurotrophic virus affecting chiefly the hind limbs of the dog is seen approximately twice each year in this area, with sporadic cases occurring throughout the year. Personal communication with the late Doctor Milks

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and Doctor Schlotthauer during one of these epizootics help confirm this opinion. Many of the neurogenic symptoms are preceded by a mild gastrointestinal upset, slight or no elevation of body temperature and some loss of appetite. The symptoms subside and are followed by weakness, ataxia, paresis, paralysis, and occasionally convulsions. Treatment with antibiotics and symptomatic therapy have resulted in a fair recovery rate. However, the weakness and paralysis complex have been difficult to remedy. Stimulants, massage, and infrared therapy have given some relief. However, since using cortisone routinely in the course of treatment during the early and later stages of the disease, the number of cases showing serious nerve complications has decreased, and those recovering from this syndrome have markedly increased.

The following histories are typical:

Case 5. Cocker Spaniel male, 12 years of age, with a history of vomiting five days earlier, listlessness, unable to climb stairs, and weakness of the hindquarters. Physical and urine examination negative. Treatment consisted of 50 mg. cortisone and vitamin B complex intramuscularly as well as vitamin and tonic tablets. The dog returned after two days in convulsions. Euthanasia performed.

Case 6. Fox Terrier bitch three years of age, with a history of fetid diarrhea and vomiting for three days, partial anorexia, temperature of 102.1 F. and weakness of the hindquarters. After hospitalization, the dog was given 100 mg. polyotic® *q.i.d.*, antidiarrheal drugs, and 100 mg. cortisone intramuscularly the first day, followed by 50 mg. daily for six more days. The dog was discharged fully recovered.

Case 7. Beagle male, four months of age, exhibiting only incoordination of the hind limbs. There was no history of injury. Onset was sudden, but no evidence of pain was present. The dog was sent home after an intramuscular injection of 40 mg. cortisone and vitamin B complex, but was returned for hospitalization the following day. Daily treatment consisted of 30 mg. cortisone *b.i.d.*, stimulants and massage. An improvement was noted on the second day, and the action of the hindquarters became normal on the fourth day, at which time the animal was discharged.

Case 8. Four-year-old Dachshund bitch. History of posterior paralysis due to a slipped intervertebral disc nine months previously. Treatment consisted of vitamins, heat, and rest. The condition persisted for five weeks before ambulation was normal. When presented again with similar symptoms, *x*-ray examination revealed calcification at the site of the old lesion. Cortisone injections of 50 mg. were given daily for three days. Vitamins and a bland diet were prescribed. Symptoms abated almost immediately and, after three days, the dog walked normally. The cortisone treatment was continued at half doses for three more days, than discontinued entirely. Three months later, the animal was returned, the hindquarters weak and the dog unable to walk upstairs. Treatment as outlined above again produced excellent results within three days.

®Lederle Laboratories Division, Pearl River, N. Y.

Otitis Externa

Excellent results were obtained in treating various infections of the external ear with a 2.5% hydrocortisone jelly. Previously, refractory cases responded remarkably well. Regardless of the form of therapy used, a thorough debridement of the ear is an absolute prerequisite to the application of any medication. While it is true that antibiotics and other drugs have been used successfully in the treatment of this type of disorder, I have found that hydrocortisone therapy has enhanced healing and shortened duration of treatment, even in the most stubborn cases.

Case 1. German Shepherd, male, three years of age. History of discharge from one ear for a month, which had been treated previously with antibiotics. The ear was sensitive, the canal lining thickened and grossly inflamed, and the ear filled with a thick, fetid, purulent discharge. It was necessary to anesthetize the animal before treatment was begun. The ear was cleansed and irrigated with a 1% chlorazene solution, then dried and packed with 2.5% hydrocortisone jelly. This treatment was continued for three days. The dog was then discharged, and a tube of the jelly dispensed with instructions for daily cleaning and treatment of the ear. The dog was returned after four days. The ear could be treated without pain to the animal. Little secretion was evident and healing of the eroded areas had progressed rapidly. By the end of ten days, treatment was discontinued. One month later, when the dog was returned for other reasons, the ear was entirely normal.

Case 2. German Shepherd, male, two years of age was presented with bilateral otitis externa. A thick mucopurulent exudate was discharging from both ears, which were extremely sensitive. Ulcerations were present on the

lining membrane of both ear canals. The client had been treating the ears with various medications for six months. Prior to treatment, 1 cc. of a 10% benzocaine solution was instilled into each ear and both ears were cleaned and irrigated as described above (case 1). A 2.5% hydrocortisone jelly was then packed in each ear canal. After daily treatment for four days, pain had decreased markedly. At the end of one week, the dog was discharged and the client was able to continue treatment without assistance. At this time, slight ulcerations were still present, but little secretion was evident and the odor had disappeared completely. The patient could be petted, the ears handled and stroked without concern to the animal. Treatment was given daily for one week, then discontinued as no longer necessary.

Case 3. Cocker Spaniel bitch, two years of age, presented with chronic otitis which had existed for seven months. A fetid, purulent secretion was present in both ears, and the conchal ridges were grossly thickened and inflamed. Cleaning, irrigation, and hydrocortisone treatment, which was given twice daily for the first three days, was possible only under anesthesia. After this time it was continued as in other cases. The dog was discharged after ten days with an estimated 90% improvement, and treated at home for two weeks. Complete recovery was apparent within 3½ weeks.

Skin Conditions

A confusion of diagnosis and interpretation of skin lesions as reported in the literature makes it difficult to convey accurately, the true nature of lesions any clinician may see. Broadly, the classification of eczema, dermatitis, and mange have been used as a catchall for the majority of skin conditions. Until a more accurate and standardized differential diagnosis based on etiologial factors is adopted, the term "eczema" will have to suffice for those stubborn skin conditions with which veterinarians are all too familiar. Cortisone has not proved to be the final answer in the treatment of these conditions, but it has helped considerably in relieving the discomfort associated with them. Hydrocortisone lotion applied to affected areas appears to be the treatment of choice in many cases of long duration. Relief from pruritus, subsidence of inflammation and stimulation of hair growth in the treated areas makes this an ideal preparation for use in stubborn cases. The cost of the medication has been the chief factor militating against more widespread use.

Case 1. Cocker Spaniel bitch, six years of age, constantly licking bare areas on front legs and groin. The skin was thickened and completely depilated. A diagnosis of eczema was made and unsuccessful treatment with various drugs was given for one month. A 1% hydrocortisone lotion, applied to the affected areas four times daily, produced a dramatic relief. Within 24 hours, the localized inflammation subsided, the pruritus had lessened to the point where the dog licked only occasionally and the animal rested comfortably during the day. After two weeks' treatment, the skin had returned to normal with new hair growing on the previously bald areas.

Case 2. Cocker Spaniel bitch, five years of age with a history of an eczematous condition which had persisted for several years. Bare areas on the right rump and thigh were present for months and the dog was scratching constantly. An extensive trauma of the skin resulted from the dog licking and biting these areas. Intramuscular injections of 50 mg. cortisone each on two consecutive days and topical application of 1% hydrocortisone lotion to the affected areas three times a day eliminated the pruritus and the dog no longer worried the lesions. The hydrocortisone applications were then continued twice daily as the only treatment. At the end of three weeks, the skin appeared normal and new hair growth had begun.

Case 3. A two-year-old Boxer, male, was presented with a history of interdigital eczema of ten months' duration. Many preparations had been used with only transient relief. When first examined, all four limbs were involved. The inflammation was so severe that the dog had difficulty walking. Local application of a 1% hydrocortisone lotion, three times daily, was without beneficial effect. A 2.5% hydrocortisone jelly was then used and gave symptomatic relief which was evident within a few hours. This treatment was continued for one week, after which the affected tissue had returned to normal. The condition returned after three months and applications of hydrocortisone jelly brought prompt relief of symptoms.

Case 4. Cocker Spaniel, male, three years of age, suffering from severe pruritus for one year. Bare areas on the lumbar and perineal regions had existed for several months. Daily intramuscular injections of 50 mg. cortisone on three consecutive days and 1% hydrocortisone lotion applied twice daily to the bare areas brought immediate and sustained relief. The hydrocortisone applications were continued until new hair began to grow.

Hyperpyrexia

The use of cortisone in this condition has simplified the treatment and brought about more rapid response in the patient. The dramatic normalizing action of cortisone in an organism under stress can be readily seen from the following case reports.

Case 1. W. H. Fox Terrier, male, 16½ years of age. This animal had collapsed at home and was unable to stand when first seen, the membranes were congested and the frequency of respirations was increased and labored. A diagnosis of heat stroke was made. Within five minutes after intramuscular injection of 75 mg. cortisone the respirations had become less labored, the mucous membranes assumed a more normal color and the dog was obviously more comfortable. Three hours later, the client called to report that the dog looked tired, but had walked outside, lapped water and was otherwise normal.

Case 2. Boston Terrier, male, ten years of age, collapsed in the client's car when they were caught in a traffic tie-up for three hours on a hot summer day. The animal had a temperature of 108.2 F., membranes were cyanotic, the respiration labored. Ice packs were applied to the head and body. Two intramuscular injections of 50 mg. cortisone each were given at 30-minute intervals. Within an hour the dog regained his feet, remained a little unsteady for several hours and was completely normal on the following morning.

Case 3. W. H. Fox Terrier, male, 12 years of age, had collapsed suddenly during a hot spell. Seen at home, the dog was unable to stand and presented typical symptoms of heat stroke. Ice packs were placed on the dog and 75 mg. cortisone injected. The client called the office four hours later and reported the dog was behaving normally.

Shock

Surgical and traumatic shock are observed commonly in dogs. Many animals are not presented for surgery or consent is not given until the patient has become a poor surgical risk. Cortisone would appear to be an ideal prophylactic and therapeutic agent in shock since this hormone is essential in the adaptation of the organism to stress. Unfortunately, there are many unknown factors still to be ascertained before so complex a condition can be brought under control by the administration of a single therapeutic agent. The use of cortisone has given some pleasant surprises in cases where it was not practical to administer the more routine intravenous therapy.

Case 1. A Cocker Spaniel, male, two years of age, was brought to the office immediately after being struck by a car. The dog was in a state of shock, and had sustained a fracture of the right radius, but no evidence of internal or external bleeding. One hundred milligrams of cortisone was given intramuscularly, the injured leg placed in a splint and the animal placed in a heated cage. Thirty minutes later, the dog was apparently out of shock. Recovery was uneventful.

Case 2. Mongrel terrier, female, four years of age. After 29 hours of labor, two puppies were delivered normally at home. The dog was weak and pituitrin failed to stimulate the atonic uterus. A cesarean section was agreed to and performed after injection of 100 mg. cortisone. Fourteen more puppies were removed, eight dead and six alive. One hundred cubic centimeters of serum was given intravenously immediately following surgery. Three hours later, the patient went into shock. Membranes were gray, the pulse weak and thready, the eyes dilated and ocular reflex absent. At this time, 50 mg. cortisone was given intramuscularly and 50 mg. intravenously, followed by rapid response. Within a matter of minutes, color returned to the membranes, the pulse became stronger and the ocular reflex returned. From this point on, recovery was uneventful. Cortisone is not recommended for intravenous use, but the nature of the case made the additional risk inconsequential.

Allergic Sensitization, Bronchial Asthma

Rapid relief from the distressing symptoms is the usual response to cortisone therapy in these allergic conditions. Urticarial wheals disappear rapidly, in many cases within a matter of minutes. Patients with bronchial asthma show a varying response. Some are granted a prolonged period of relief with a minimum of treatment; others require continual treatment for suppression of symptoms.

Case 1. English Bulldog, male, three years of age, presented with diffuse urticarial wheals over the entire body. Eyelids were swollen shut, the vulval labia swollen three times normal size. One injection of 75mg. cortisone brought about regression of the wheals while discussing the treatment with the client.

Case 2. Mongrel terrier, male, nine years of age, suffering from asthmatic cough for one month was presented for treatment. The dog had not been able to sleep for the past three nights. Injections of 50 mg. cortisone each were given on four consecutive days, as well as phenobarbital at the rate of 15 mg. twice

daily. The severe persistent cough disappeared rapidly, although the owner reports on some days an occasional cough may be heard.

Case 3. Mongrel terrier, 14 years of age, presented for euthanasia. The animal could not sleep because of a persistent asthmatic cough and the entire family had been up for several nights. The dog was hospitalized at my request and 100 mg. cortisone was injected daily for three days. No other treatment was given. The cough subsided after the first injection and the dog responded sufficiently to be discharged after three days. According to the owner's reports, the animal spent restful nights with only an occasional bout of coughing. Following treatment the animal became more active and, in the words of the owner, "looks years younger". When the dog is returned about once every month when the cough seems to intensify, one or two injections of cortisone relieve the attack.

Summary

Cortisone has a broad field of application in small animal medicine. Many conditions of diverse nature appear to be cured or favorably influenced when cortisone and the allied preparations are used in adequate dosage. Some of the diseases are listed in this report with case histories to illustrate successful use in one practice. The adrenocorticoid hormones are not catholicons, and their use should be based upon an understanding of the pathologic physiology underlying a given disease process. Because of their alleged operation at basic planes of cellular physiology, wide use can be made of their effects.

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Stilbestrol-Fed Beef Tripe Safe for Mink

Under specific conditions of two experiments caused to be conducted by the National Mink Board, it was concluded that tripe from steers fed stilbestrol at recommended levels has no adverse effect on mink.

Results were in variance with previous experimental data which indicated that the synthetic estrogen at the 5-micrograms level resulted in lowered kit production. These experiments indicated no significant difference between treated and control groups.

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No client will long use veterinary service in which he has little confidence.

Canine Artificial Insemination Project

Artificial insemination of dogs on an international scale may be in the offing, according to Harry Miller, director of the Gaines Dog Research Center, New York, who revealed that serious work on such a project has been going on since the first of the year.

Cooperating with the Gaines Dog Research Center in this project, is Dr. A. E. Harrop, lecturer in animal husbandry at the Royal Veterinary College, University of London, England, and in this country Dr. Ellis P. Leonard, professor and head of the department of therapeutics and small animal diseases, New York State Veterinary College, Cornell University. Dr. Harrop has been successful in producing pregnancy with preserved semen in a bitch in his homeland, and also has succeeded in adapting the deep freeze technic to canine semen.

Samples of preserved semen in special containers are dispatched via air by Doctor Harrop to Doctor Leonard, who tests specimens for motility and morphology. Up to the present, fertility capacity of the preserved semen sent from abroad has been 173 hours.

Doctor Leonard has at his disposal a group of bitches for use in these long-distance preserved semen tests. Dr. H. C. Stephenson, veterinary consultant to the Gaines Dog Research Center, is acting as liaison on this project, and visited with Doctor Harrop on a trip to Europe from which he recently returned.

Artificial insemination of dogs has been tried to only an extremely limited extent, usually in situations where natural matings could not be managed. But preserved semen could mean the freer interchange of good blood lines heretofore impossible because of geographical distances or quarantine restrictions of certain countries. It offers also some disease control advantages.

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The July 1955 release, All About Dogs (Gaines Dog Research Center, New York) quotes Dr. Gerry B. Schnelle, director of the Angell Memorial Animal Hospital, Boston, Mass., on early or delayed spaying of bitches as follows: "Spaying at three to seven months of age (before the first heat period of the female) actually is done for the convenience of the dog's owner and perhaps the veterinarian. Sluggishness of behavior is more apt to develop when the female dog is spayed young."

Debarking In A Kennel: Technic And Results

A. C. ANDERSEN,* V.M.D., Ph.D., Davis, California

THIS report describes the operative procedure and the results following debarking 400 Beagles constituting this kennel**. Occasional outbursts of barking by these dogs created an annoyance that necessitated a control measure. Because the operation is generally considered to be effective for only a few weeks or months, ventriculocordectomy was not performed until other means of control failed. The gratifying results continuing a year and a half later seem worthy of mention. A brief anatomical review of the vocal cords is presented, as well as the surgical procedure and the healing which follows surgery.

Surgical Anatomy of the Vocal Cords

Opening the dog's mouth to provide inspection of the epiglottis, located in the posterior pharynx, reveals the epiglottis forming the anterior boundary of the laryngeal vestibule as described by Bradley[1]. Depressing the epiglottis or elevating the larynx dorsally brings the V-shaped vocal cords into view as shown in figure 1. The vocal cords appear as thick folds extending from the vocal processes of the arytenoid cartilage downward and medially to the thyroid laminae. Immediately anterior to the vocal cords are the ventricles of the larynx, appearing as large cul-de-sacs in the lateral walls of the vestibule.

The vocal cords are formed in large part by the vocalis muscle; other tissue consists of connective tissue, mixed glands, and lining epithelium[2]. These structures are more fully developed in dogs over four months of age. Therefore it is not advisable to remove the vocal cords before puppies are four to six months of age.

Surgical Procedure

General anesthesia is required. Ether is preferred to the barbiturates, as profound anesthesia and complete relaxation of the vocal cords is pot desirable.

With the animal under ether anesthesia, one attendant opens the mouth by holding the upper jaw and pulling the tongue forward and downward to allow visibility of the epiglottis. The vocal cords are brought into view by a second attendant securely holding and manipulating the larynx from the outside. This method is preferred to that of grasping the epiglottis as described by Riser[3]. Occasionally it is advantageous to allow the animal to partially recover from anesthesia and contract the vocalis muscle to aid in the removal of the vocal cord.

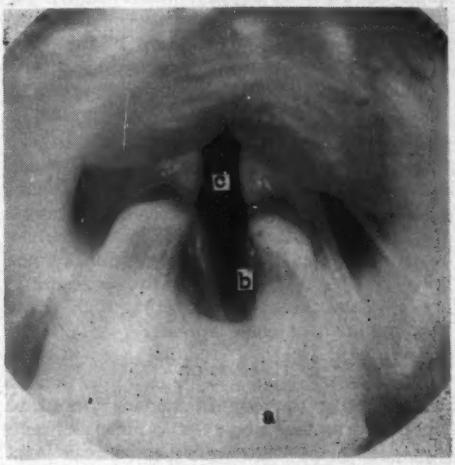

Fig. 1. Laryngeal vestibule, (a) epiglottis depressed, (b) vocal cords, (c) rima glottidis. 2x.

Although many types of instruments may be used for debarking, the Sangemeister biopsy punch and the Bozeman forceps (fig. 2) have been found to be the most satisfactory. A pledget is grasped with the Bozeman forceps to remove any excess of mucus in the pharynx or larynx. The Sangemeister biopsy punch, held in the opposite hand, is placed over the vocal cord with the cup of the instrument deeply inserted into the ventral part of the laryngeal ventricle. The hook holds the vocal cord firmly within the punch. Since this punch has a serrated rather than a cutting edge, the instrument is rotated outward as it is closed to cause a slight tearing of the cord. A section

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**Atomic Energy Commission, project no. 4, Contract AT-11-1 Gen. 10, The Effect of Radiation on Work Capacity and Longevity of the Dog.

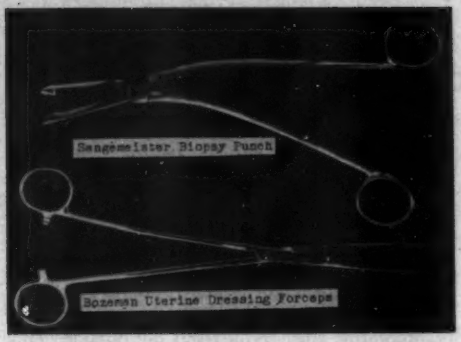

Fig. 2. Ventriculocordectomy instruments. The Bozeman forceps is used to remove excessive mucus. The Sangemeister biopsy punch provides a crushing cup with serrated margins and a hook to hold the tissue securely.

is removed from the opposite vocal cord in a similar manner. Large vocal cords may require the removal of more tissue than is accomplished by a single punch. Any tissue remaining after the lower portion of the vocal cord has been sectioned appears as a protruding nipple in the dorsolateral vestibule. This tissue should be removed with the punch.

Although a small amount of hemorrhage is observed soon after the biopsy punch is made, excessive hemorrhage has not been experienced with the above-described operative procedure. No fatalities have occurred following the debarking of the 400 beagles in this kennel; however, the usual postoperative precautions are advisable. The operation required about four minutes for each animal.

Discussion

To deprive the dog of barking would be inhumane, as this activity is a means of self-expression and protection for the animal. Dogs vary considerably in the volume and frequency of their bark. Those animals possessing the loudest bark often encourage otherwise quiet animals to join in this activity, resulting in an outburst that can be heard for a considerable distance. Such outbursts become annoying to the personnel as well as to residents in the area surrounding the kennel.

Properly performed ventriculocordectomy immediately reduces the voice to a low and husky utterance. Many animals start barking in a mellowed tone upon recovery from anesthesia, indicating that the operation is not painful. Within a few days, both the volume and frequency of barking are greatly reduced. However, partial recovery in the volume of the bark is observed within a few weeks following ventriculocordectomy.

One and one-half years after debarking, the animals in this kennel, the total volume of barking is estimated as having been reduced between one-half and two-thirds. Also, outbursts of barking are less frequent. Even when barking does occur in the kennel, an ordinary conversation can be heard that could only have been carried on with difficulty before the operation. Consequently, working conditions have been greatly improved, and frequent complaints from people within one to two miles of the kennel have ceased.

Because of these results, laryngeal examinations of animals operated upon several months previously have been conducted. Direct examination of the vestibule in these animals reveals the vocal cords as depressed, thickened columns with the free margins forming an irregular rima glottidis. This is in contrast to the sharply defined straight margins of the V-shaped vocal cords found in the normal larynx shown in figure 1. Figure 3 illustrates a lateral view of the normal cord as compared with that from an animal debarked one year previously.

Fig. 3. Lateral view of the larynx showing, (a) the normal vocal cord, and (b) the vocal cord one year following ventriculocordectomy.

It will be noted that approximately two-thirds of the vocal cord in the debarked dog is represented by a slightly elevated mass of tissue, figure 3,b.

Histological comparison of the vocal cords from normal and debarked animals reveals only partial regeneration of the tissue after ventriculocordectomy. The margins of the healed vocal cords are reduced in height. The striated muscle fibers that normally extend from the vocalis muscle toward the free margin of the vocal cord are absent in the regenerated tissue. The lining epithelium, mucosal mixed glands, and connective tissue regenerate and appear similar in structure but lesser in quantity than those found in the normal cord. Therefore, it appears evident that the success of surgery depends upon the extent of tissue removed, especially that of the vocalis muscle located at the base of the vocal cord.

Conclusion and Summary

Ventriculocordectomy can be satisfactorily performed under ether anesthesia with the Sangemeister biopsy punch. The 400 Beagles debarked in this kennel demonstrate a lowering in the tone and volume of the bark to a mellowed but husky utterance. Barking frequency also has been reduced. Elevating the tone has not been observed when the described operative technic is followed. Working conditions in this kennel have been improved greatly since this operation was performed one and a half years ago, yet the animals continue to enjoy the privilege of barking.

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Pet Health Plan, Inc., of Los Angeles, Calif., offers "complete medical - surgical - hospital protection" for any sick or injured pet for a $20 annual fee.

It is understood that plans are progressing in the California metropolis, that local practitioners have been solicited, and that considerable funds have been made available for establishment of facilities to handle large numbers of dogs and cats. Qualified clinicians are to be employed. Some questions exist concerning the legality of the operation as the plan appears to involve more than sickness and accident insurance for pets.

Rabies in Wild Life

An explosive outbreak of fox rabies is reported by Dr. Martin Hines chief, Veterinary Public Health Section, North Carolina State Board of Health, in Allegheny County. Since spring, some 77 rabid foxes have been reported. Cattle deaths due to rabies now have reached 60 head and 22 persons are under treatment for exposure. An organized trapping program has been initiated in an effort to control spread of the disease among wild life of the region.

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"Why People Own Dogs"

Will Judy, editor of *Dog World* comments editorially that people own dogs because of their usefulness, the companionship offered, or for reasons of personal vanity.

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Difficulties concerned with semen preservation that have interferred with progress in artificial insemination in dogs is reported in *British Vet. Jour.* for October 1954, to be largely overcome. Canine semen can be held for 100 hours by adding collection to pasteurized milk in a ratio of one part semen to seven parts milk previously heated slowly up to 92 to 94 C. and subsequently stored at 4 C. after slow cooling.

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Tying the spermatic cord and artery together with a surgeon's knot is proposed by Aranez (*Jour. Am. Vet. Med. Assn.*, 126:457 [June], 1955) after removal of the testicles from cats. He reports that wounds remained dry, healed in five to seven days without hemorrhage, infection, or scirrhous cord development in a group of seven cats presented for surgery.

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Fleas are likely vectors of *Dirofilaria immitis*, the dog heartworm, according to report appearing in the October 1954 issue of the *Journal of Parasitology*.

When fleas were restricted to known infected dogs, practically all became infected. The larvae caused no apparent effect on the activity of the insect.

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The science of nutrition and metabolism is young but vigorous.—*Richard H. Young, M.D.*

The Response Of Young Mink To Varying Lengths Of Exposure To Nebulized Egg-Adapted Distemper Virus (DV)

R. K. FARRELL,* D.V.M., J. R. GORHAM,* D.V.M., Ph.D., and L. O'NEILL*, Pullman, Washington

RECENT studies in this laboratory and elsewhere have shown that an airborne exposure of living modified distemper virus (DV) vaccine will evoke a rise in serum neutralizing antibody or stimulate resistance in mink and ferrets. According to available literature, there have been no investigations on the relationship of the length of the exposure period to infection. Ferrets have been immunized after one-hour[1] and three-minute exposures[2]. Similarly, mink have become infected after an exposure period of three minutes[3]. Vaccine has been sprayed with commercially available insect sprayers[3,4]. In this study an investigation was made to determine the period of exposure to nebulized, egg-adapted virus required to cause infection.

Materials and Methods

Animals. Mink kits from the stock herd of the Pullman Fur Animal Disease Research Laboratory were used as test animals in this investigation. All dams were vaccinated with egg-adapted vaccine three months prior to breeding. The animals were raised in semi-isolation and were in good physical condition at the time of the experiment. Their ration consisted of horsemeat and fish (70%), commercial cereals (20%) and dried skim milk (10%). An approximately equal number of males and females were used.

Vaccine. Haig's Onderstepoort strain of egg-adapted DV from the 88th chorioallontoic membrane (CAM) transfer served as a source of virus. The infected CAM's (inoculated seventh day and harvested on the 13th day of embryo incubation) were ground for a total of two minutes in a Waring blendor which was chilled intermittently during grinding. Heat (56 C.) inactivated, sterile horse serum was added to give a 1:2 virus dilution. Each ml. of this mixture contained 2,000 units of penicillin G and 200 micrograms of dihydrostreptomycin sulfate. The mixture was centrifuged at 6,000 r.p.m. for 30 minutes in an International refrigerated centrifuge. The supernatant fluid was removed, quickly frozen in 4 ml. quantities and stored at —20 C. until used. Sterile nutrient broth (Difco) was added at the time of the air-borne exposure to give a 10^{-1} dilution of virus. The 50% infective dose ($i.d._{50}$) in chicken embyros was calculated by the Reed-Muench formula to be $10^{4.5}$ per 0.1 ml[5].

Air-borne Vaccination. The method of exposing young mink to nebulized virus does not differ from the method previously reported[2,3] except that in the present experiment a mink nest box served as the exposure chamber. The box, which measured 14 x 11 x 10 in. was fitted with a hole to allow the introduction of the orifice of a DeVilbiss* 40 type nebulizer. The nebulizer was operated at a pressure of three pounds as produced by a Cenco vacuum-pressure pump. At this pressure, the particular nebulizer employed required approximately 2.2 minutes to nebulize 1 ml. of distilled water. Individual mink were placed in the nest box for the stated exposure period, and immediately removed. An electric fan was utilized to dissipate any residual aerosol in the box before another mink was introduced.

Neutralization Test. The technic was the same as employed in earlier studies[3,6] and need be described only briefly. In this study, serial ten-fold dilutions of serum were used with 320-625 units ($i.d._{50}$) of virus. The virus-serum mixtures were incubated at 5 C. for 24 hours. Four eggs received each inoculum. The pre-exposure serum samples utilized two-fold dilution with six eggs for each virus-serum mixture.

*Fur Animal Disease Research Laboratory, A.R.S., USDA, in cooperation with the Department of Veterinary Science, Washington Agricultural Experiment Stations, The State College of Washington.

Scientific Paper No. 1392. Project 917. Washington Agricultural Experiment Stations, Pullman.

*The DeVilbiss Company, Toledo, Ohio.

Experimental Results

Passive Antibody Levels. One hundred twenty one mink were used in the vaccination trial. At the time of the air-borne exposure (July 12, 1954) their ages ranged between 51-73 days. Blood specimens collected from eight young mink selected at random revealed low levels of serum neutralizing antibody (table 1).

TABLE 1. Neutralizing Antibody Levels from Serum Collected from Mink at the Time of Exposure

Mink No.	Mink Kits' Days Age at Exposure Time	Log ND_{50}* Doses per 0.1 ml.
72	73	0.7
73	61	1.2
74	61	1.0
75	61	1.2
99	61	1.0
100	61	0.7
101	57	0.7
106	58	1.2

*50% neutralizing dose.

Fifteen days later, the ten mink of the unexposed control group were bled and their serums subjected to a neutralization test. No neutralizing capacity could be demonstrated in any of the samples. Therefore, it is probable that most of the mink exhibited low levels of serum neutralizing antibody, engendered by passive transfer from the dam, when exposed to the nebulized vaccine.

Vaccination. Before the test exposures, the young mink were divided into 11 groups with ten mink to a group, with one group comprised of 11 individuals. The nebulization time periods of less than one second (the equipment used did not allow a more accurate designation) through three minutes were used. One group (control) was not exposed to the air-borne vaccine. All exposed mink, along with the unexposed controls, were bled by cardiac puncture, at the termination of the trial (36th day after exposure).

The data presented in table 2 indicate that the ratio of infection to exposure was 80% or more in all groups having individuals exposed to eight seconds or more of nebulized virus. Serums collected from the unexposed group exhibited no capacity for neutralization. With the exception of the one mink that became infected in the less than one second exposed group, the geometric mean titers were similar.

Discussion

In the present experiments, exposure periods of eight seconds or more resulted in approximately the same percentage of infection. The data suggest that even with the longer exposures, it was not possible to cause infection in every mink exposed. Certainly this fact must be considered when field studies are pursued, since the majority of all parenterally inoculated mink become resistant.

It is noteworthy that Bankowski and Hill[7] were not able to immunize all chicks by exposing them to an atmosphere of their tissue culture strain of Newcastle disease virus (NDV). Although their strain of NDV limits spread by contact to a minimum, other strains of virus are apparently transmitted from vaccinated to susceptible pen mates. That at least two egg adapted strains of distemper virus are not transmitted by contact has been demonstrated by workers at this station[8] and Cabasso[9] who used the Onderstepoort and the Lederle strains, respectively.

When vaccination is accomplished in the conventional manner, many mink are infected with virulent virus during outbreaks. Mink handling gloves are probably the most important fomite. The movement of animals during inoculation also offers ready means of direct transmission of the virus. Even though all the mink would not receive protection by spray vaccination, it would markedly reduce the possibility of spread of virulent virus by direct and indirect contact, since these mink would be sprayed in their own nest box without handling. Recently, Canadian workers[4] have used spray vaccination in a mink distemper outbreak. Only extensive field and laboratory investigation will establish whether air-borne vaccination by means of dusts[10] and sprays is superior to parenteral inoculation.

TABLE 2. Response of Young Mink to Varying Lengths of Exposure to Nebulized Egg Adapted Virus

Length of Nebulization	No. Infected/ No. Exposed	Geometric Mean Titer of Infected Mink*
< 1 second	1/10	3.3
1 second	7/11	2.6
2 seconds	7/10	2.7
4 seconds	5/10	2.4
8 seconds	9/10	2.7
16 seconds	9/10	2.7
32 seconds	8/10	2.7
1 minute	8/10	2.7
1½ minutes	10/10	2.8
2 minutes	8/10	2.8
3 minutes	9/10	2.8
Control mink receiving no exposure	0/10	....

*Log ND_{50} (50% serum neutralizing dose per 0.1 ml.)

The low levels of passively transferred antibody apparently did not inhibit active immunization; however, definite proof was not obtained in those individuals that were refractory to exposure.

In this investigation the criterion of infection was serum neutralizing antibody estimates. The correlation of such antibody and active immunity to distemper is a problem currently being conducted in mink, foxes, and dogs.

The mink were not exposed to virulent DV following the last bleeding because present methods of challenge are not satisfactory. Many mink having no previous experience with the virus fail to show signs of infection when challenged.

Summary

The response of young mink to exposure periods of less than one second through three minutes was determined. The data indicate that the chances of infection are at least 80% in all animals receiving eight seconds or more of exposure.

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Hydrocortisone is of real value in any external ocular disease produced by allergens, toxins, irritants, or physical trauma, especially for its inhibition of corneal vascularization.—*W. G. Magrane, D.V.M.*

Nocardiosis in the Dog: A Case Report

K. T. MADDY,* D.V.M., M.P.H.,
M. E. STROUD,** and L. AJELLO,*** Ph.D.

On November 30, 1954 a small, mixed-breed, stray dog bit a seven-year-old Phoenix, Ariz. boy on both legs. The bite was unprovoked. The dog was quarantined at the city pound. Although no illness was observed, the animal died eight days later. The dog was examined in the Phoenix Laboratory of the Arizona State Department of Health.

On impression smears of the brain, many small inclusion bodies were seen, but Negri bodies were not demonstrated. Sections of the brain were referred to the Virology Laboratory of the Communicable Disease Center, Public Health Service, U. S. Department of Health, Education and Welfare, Montgomery, Ala. for inoculation studies. The rabies virus was not isolated in 21 days.

A large abscess, filled with purulent material, was observed in the cerebellum, extending up into the cerebrum and well back into the medulla on the right side. (See fig. 1.). Several tubes of Sabouraud's dextrose agar were inoculated with pus from the abscess and an aerobic actinomycete was isolated.

The fungus grew well at both 25 C. and 37 C., producing white, chalky colonies. Examinations of slide cultures failed to reveal the development of spores, although the mycelium broke up readily to form coccoid- and bacillary-shaped elements. The mycelium measured approximately 1 micron in diameter and proved to be acid-fast when stained with Kinyoun's acid-fast stain.

Pathogenicity tests were carried out by inoculating 1 ml. of equal parts of mycelial suspension and 5% gastric mucin intraperitoneally into guinea pigs. One guinea pig died ten days following inoculation. At autopsy, numerous lesions were found on the peritoneum, liver, spleen, and diaphragm. Smears from these revealed the presence of acid-fast, branching filaments 1 micron in diameter. The second experimental animal was sacrificed on

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the 14th day and similar findings were noted. On the basis of these observations, the organism was identified as *Nocardia asteroides*.

Discussion

A review of the literature reveals that authenticated cases of *N. asteroides* infection have been found only in man and dogs.

McGaughey[1] reported that since 1882 about 45 to 50 cases of actinomycosis in dogs had been recorded. In few of these was the organism isolated and identified. Some of these dogs may have been infected by the actinomycete *N. asteroides* but there is no proof of this.

Balozet and Pernot,[2] in 1936, appear to have been the first to have identified *N. asteroides* as the infectious agent in dogs. In 1948, Ginsberg and Little[3] also isolated this fungus. Bohl *et al.*,[4] in 1953, made the first definite report in American literature of a dog infected by *N. asteroides*. Since then, several other cases have been reported by Cross *et al.*[5] and Blake[6]. Due to incomplete morphological studies, the identity of the aerobic actinomycete isolated by Thordal-Christensen and Clifford[7] from a dog remains unknown.

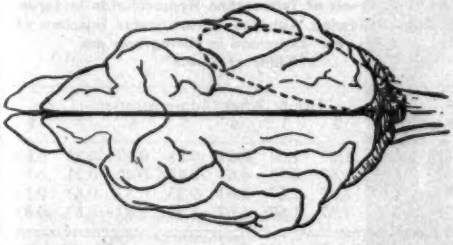

Fig. 1. Drawing of the dorsal aspect of dog's brain. Dotted line indicates boundaries of abscess.

All evidence indicates that in dogs the pulmonary lymph nodes and lungs become involved primarily. Dissemination may then follow with abscesses developing elsewhere in the body.

N. asteroides infections in man would appear to be rare since only 46 have been recorded according to Bernstein *et al.*[8]. It is likely that human infections are more prevalent than these figures would indicate, as undoubtedly, many cases remain unreported. For example, the Communicable Disease Center, Mycology Unit has identified 26 cultures of this organism in the course of its diagnostic work during the past four years. These cultures, received from state health departments, were isolated from cases which have not been reported.

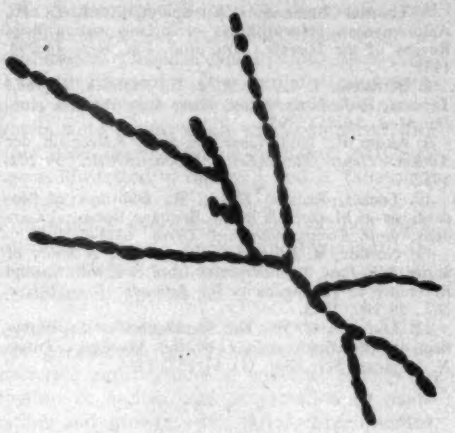

Fig. 2. Drawing from stained smear of Nocardia asteroides.

It is probable that *N. asteroides* infections occur in lower animals other than the dog, but in suspected cases mycological proof has been lacking. The identity of the Nocardia species isolated by Akun[9] from two cats in Turkey and by Tucker and Millar[10] from four marsupials in Australia has never been established.

Since *N. asteroides* has been isolated from soils by several investigators,[11,12] it is probable that both man and lower animals become infected by inhalation of airborne fragments of the fungus. There is no evidence of transmission of infections through contact.

Summary

The eighth reported case of canine infection definitely diagnosed as caused by *Nocardia asteroides* is described. This is the fourth case reported in the Continental United States and is the first reported in an Arizona dog.

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Intramuscular Tetracycline in Small Animal Medicine

J. LAVERE DAVIDSON,* D.V.M., KENNETH B. HAAS,* D.V.M., and GORDON G. STOCKING,* D.V.M., Kalamazoo, Michigan

The role of oral panmycin® in animal medicine was considered in a previous article (Indication and Use of a New Antibiotic in Veterinary Medicine. *Vet. Med.*, 50:215 [May], 1955). The present article concerns intramuscular use of this newest broad-spectrum antibiotic in small animal medicine.

The antimicrobial action of panmycin, tetracycline hydrochloride, includes both Gram-positive and Gram-negative bacteria, and Rickettsia. Panmycin is more water-soluble than chlortetracycline and more stable than either chlortetracycline or oxytetracycline. There are slight differences, however, in sensitivity of organisms to various members of the tetracycline family. The chief advantages of tetracycline itself are lesser incidence of antibiotic side-effects and higher antibiotic levels in blood and spinal fluid, as compared to oxytetracycline and chlortetracycline.

Indications

Intramuscular panmycin is indicated in the treatment of a wide variety of canine and feline infections caused by tetracycline-sensitive bacteria. Some of these are: Bronchitis, tonsillitis, feline panleukopenia, parotitis, pharyngitis, infectious coryza, pneumonia, bacterial complications associated with either the canine distemper or hepatitis complex, otitis media, nephritis, peritonitis, ulcerations, and abscesses. Other indications include bacterial infections, with or without bacteremia, following wounds or surgery and for control of tetracycline-sensitive secondary bacterial infections associated with or subsequent to virus diseases.

Administration and Dosage

Injection of aqueous solutions of panmycin should be made deep into the gluteal muscles of small animals. The usual semimembranosus or semitendinosus injection may result in a transitory pain reaction. The site should be alternated on repeated treatments. The total daily dose for dogs and cats is 2 to 5 mg. per lb. of body weight.

The following chart demonstrates serum levels in dogs following intramuscular administration of tetracycline hydrochloride. The chart demonstrates that tetracycline is found in the serum in significant amounts during the first hour after aqueous intramuscular injection and that detectable levels are maintained for at least nine hours.

CHART I. Levels of Tetracycline Hydrochloride in Serum of Dogs Following Aqueous Intramuscular Injection of 5 mg./kg. Expressed in Micrograms per Milliliter of Serum*

	Hours After Administration							
Dog	1	2	3	4	5	6	7	8
230	1.67	1.67	1.67	0.83	0.83	0.83	0.83	0.83
232	1.67	1.67	0.83	0.83	0.42	0.42	0.21	0.21
234	1.67	1.67	1.67	1.67	0.83	0.83	0.83	0.83
235	3.33	1.67	1.67	1.67	1.67	0.83	0.83	0.83

*Data from the Research Laboratories of The Upjohn Company.

The popularity of parenteral medication, and particularly the wide demand for effective broad-spectrum antibiotics in small animal practice, leads the writers to believe that there is a wide scope of application for intramuscular panmycin.

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In spite of major changes in methods of practice, one principle remains unchanged; a practitioner must give service proportionate to the fee charged.—*Charles C. Rife, D.V.M.*

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Application of new knowledge of the fundamental processes of body fluid dynamics is one of a number of fields of clinical medicine that has made possible significant support to body defences against disease.

*Department of Veterinary Medicine, Medical Division, The Upjohn Company.
®The Upjohn Company, Kalamazoo, Mich.

Treatment of Growth Failure in Dogs: A Clinical Report†

R. E. BROWN, D.V.M., Lansing, Michigan

A not uncommon problem in dogs, particularly short-nosed breeds, is a retardation of the normal growth pattern. Animals usually are seen first when they are between two to six weeks of age, and show an enlarged head out of proportion to the stunted body, ascites, and patent fontanelles. If untreated, the condition is often terminal; if pups live, their abnormal conformation makes them valueless to the owner.

Previously, treatments consisted mainly of vitamins, good diet, and nursing care, but the results obtained following this line of therapy were not beneficial. The interesting effects of ACB_{12}® in other cases[1] led us to investigate its use in these developmental difficulties.

To date, eight Boston Terriers and one Pekinese have been treated with the drug. On presentation, physical examinations were completed on these nine dogs, and their measurements and weights recorded. Admission photographs were taken which were compared with other films taken prior to discharge. A typical case is illustrated in figures 1 and 2. Treatment consisted of 0.4 cc. ACB_{12} administered intramuscularly every second day for one week, followed by single weekly injections until the pups had attained normal size — usually about six to ten weeks.

In the cases treated, the response to ACB_{12} was immediate. All animals exhibited remarkable improvement in appetite, prompt reduction of ascites, and acceleration in ossification and growth rate. After three months, the animals were comparable in every way to their normal littermates.

The mechanisms involved in this retardation of the growth pattern are not known. It has been suggested that a congenital hydrocephalus may be present[2] which might account for the enlarged head, separation of the cranial bones

†Presented before the Michigan State Veterinary Medical Association Annual Meeting, Jackson, Mich., June 23-24, 1955.

®Armour Veterinary Laboratories, Kankakee, Ill.

Fig. 1. Six-week-old Boston Terrier prior to treatment.

Fig. 2 The same animal at conclusion of treatment. Age four months.

and patency of the fontanelles past their normal time of closure.

While the number of cases reported is small, the favorable response obtained in all cases following the use of ACB_{12} encourages its continued investigation. Future clinical cases are deserving of more intensive studies in an attempt to discover the etiological factors responsible for the condition. These studies should include thorough cytologic and chemical blood examinations with particular reference to changes in protein and electrolyte fractions, radiographic, and if possible, encephalographic work-ups to determine bony and ventricular involvements.

Summary

Nine puppies ranging in age from four to six weeks were treated with ACB_{12} for developmental retardation. An excellent growth response was obtained, and at three to four months of age, treated animals compared favorably to their unaffected littermates.

The early restoration of a normal growth pattern following the use of ACB_{12} in the reported cases warrants its continued investigation in the therapy of similar conditions.

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"Dropped Muscle" in Greyhounds

Careful dissection of the affected leg and the normal of racing Greyhounds which had suffered "dropped muscle" revealed that this common condition in either rear limb of racing dogs is generally a spontaneous rupture of the gracilis muscle[*]. Muscle fibers in one instance were torn away from their distal attachment to the tendon of the semitendinous. It was concluded by the authors that the major portion of the gracilis is an important extensor of the hock.

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Geneticists have established that cryptorchism is hereditary. Those who criticize action taken to prevent monorchid dogs from acquiring championship points have not considered the long-range influence of this undesirable, sex-linked, inherited characteristic.

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[*]Frandson, R. D., and Davis, Robert W., "Dropped Muscle" in the Racing Greyhound. *Jour. Am. Vet. Med. Assn.*, 126:468 (June), 1955.

Euthanasia

The word euthanasia is from the Greek meaning "well death". Destruction of animals, especially pets, and including large animals, is still a problem for veterinarians. Thoughtful care and selection of agents and technics are necessary if it is performed so that the animal has no premonition of what is to take place, no disturbance of the alimentary tract, and no pain. Strychnine causes terrific reaction; opium alkaloidal salts usually cause vomiting until sedation sets in; stunning, at least in packing houses, where it is practiced in America, causes fear and excitement in those cattle not yet stunned; division per rectum, in the horse, of the posterior aorta is not without unpleasant features, mentally at least, to the owner if he is a witness; intravenous magnesium sulphate to dogs has at least ten to 20 seconds of premonition; shooting is frequently messy in the hands of the inexpert, and so on. If any veterinarian knows of a lethal agent or process, and will give it publicity, for the quick, painless, nonpremonitory euthanasia of animals, he will be rendering a distinct service.—*R. R. Dykstra, D.V.M.*

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Dr. James Lieberman, Veterinary Training Consultant, with the Training Branch of the U. S. Public Health Service's Communicable Disease Center in Atlanta, has recently returned from a two and one-half month assignment in Geneva, Switzerland, where he served as veterinary public health consultant to the European Regional Office of the World Health Organization of the United Nations. Doctor Lieberman was responsible for organizing an Advisory Group on Veterinary Public Health which met in Geneva from June 6-10, 1955. While there he devoted considerable time to evaluating the extent of veterinary public health problems in European countries. This included a survey, now being compiled, of instruction in preventive medicine and hygiene in over 40 schools of veterinary medicine in countries comprising the European Regional Office.

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"Every now and then go away, have a little relaxation, for when you come back to your work your judgment will be surer, since to remain constantly at work will cause you to lose power of judgment . . . Go some distance away, because then the work appears smaller, and more of it can be taken in at a glance, and a lack of harmony or proportion is more readily seen."—*Leonardo da Vinci.*

Observations On The Effects Of Oral And Intravenous Doses And Chronic Oral Administration Of Mephenesin (3-o-Toloxy-1,2-propanediol) In Horses†

D. K. DETWEILER, V.M.D., M.S., M. J. SILVERMAN, D.V.M., M.Sc., J. JENNY, Dr. Med. Vet. (Zurich), Philadelphia, Pennsylvania

MEPHENESIN, also known as tolserol®[1], lissephen®[2], and myanesin®[3], produces relaxation of striated muscle through its action (interpreted as internuncial blockade) on the central nervous system, especially the brain stem and spinal cord. It also has sedative and local anesthetic effects. It has been employed as an adjunct to anesthetics to increase muscular relaxation, as a muscular relaxant in spastic and hyperkinetic disorders, in tetanus, and as a sedative in certain anxiety states.

The observations reported herein were undertaken to provide a background for further experimental and clinical investigation of the actions and use of this drug in horses.

Chronic Oral Administration

Two adult (12- and 14-years-old) draft mares weighing 990 lb. (450 kg.) and 1155 lb. (525 kg.), respectively, were fed mephenesin daily for 36 days. Each horse received 100 gm. (approximately 222 and 190.5 mg./kg.) of the drug daily in two divided doses, given with the feed. The horses were fed a conventional diet of mixed hay and oats and watered morning and night. They were stabled in standing stalls and exercised by walking two or three times weekly. A daily record of pulse rate, respiratory rate, rectal temperature, food and water intake was kept and hemoglobin level, hematocrit, erythrocyte count, total and differential leucocyte count were determined and urine samples analyzed at weekly intervals. The body weight was recorded at the beginning and end of the trial. The horses were killed and examined postmortem*. From each horse histological sections of the thyroid gland, adrenal gland, ovary, lung, heart, esophagus, stomach, small intestine, colon, lungs, pancreas, lymph glands, spleen, brain, spinal cord, bone, bone marrow, muscle, kidney, bladder, uterus, and skin were prepared and examined.

There was no alteration in food and water intake nor fecal elimination during the trial. The pulse rate, breathing rate, and rectal temperature did not show any abnormal variations. There was no significant weight loss. There were no changes in the blood and urine which could be attributed to the drug. Gross and histological postmortem examination of the tissues revealed no changes suggesting toxic drug effects. It was concluded that, under the conditions of this experiment, the daily oral administration of 100 gm. of mephenesin for 36 days did not produce clinical or postmortem evidence of toxicity in these two horses.

Intravenous Administration

Five adult horses weighing from 450 to 500 kg. were employed. Doses of 4 gm. (approximately 8.3 to 9.2 mg./kg.) given over a period of from six to ten minutes produced incoordination and sedation. There was no significant change in pulse rate, respiratory rate, or blood pressure (one animal). Incoordination lasted from 25 to 35 minutes. Marked incoordination lasted from eight to ten minutes. The sedative effect failed to occur in one horse. When an additional 2 gm. were given one-half hour later marked incoordination developed but the horse struggled with some violence and was not quieted by the drug.

†This work was supported by a grant from E. R. Squibb and Sons who also provided the mephenesin.

[1][2]E. R. Squibb & Sons, New York, N. Y.

[2][3]Abbott Laboratories, Inc., North Chicago, Ill.

[3][3]Biorganic Laboratories, Inc., East Patterson, N. J.

*We wish to express our appreciation to the Department of Pathology, University of Pennsylvania, School of Veterinary Medicine, for making the gross and histological examination of these tissues.

In one horse, nine doses of about 2 gm. (approximately 4.4 mg./kg.) each repeated at intervals of from ten to 25 minutes over a period of two hours and 31 minutes did not produce marked effects beyond slight incoordination, despite the fact that a total of 18.5 gm. (approximately 41.1 mg./kg.) were given.

Oral Administration

Three adult horses were used. Doses of from 20 to 150 gm. (approximately 41 to 344 mg./kg.) were administered in aqueous suspension through a stomach tube. A dose of 36 gm. (approximately 82.5 mg./kg.) produced slight incoordination which disappeared if the animal was excited. A dose of 72.5 gm. (approximately 166 mg./kg.) produced marked incoordination and sedation, starting about 25 minutes after administration. Doses of 100 gm. (approximately 206 to 229 mg./kg.) produced profound incoordination and depression often with recumbency. Marked incoordination developed within five to 14 minutes and the horses usually went down quietly without struggling 14 to 18 minutes after administration. The horses remained recumbent from two to 45 minutes and regained their feet without excitement. Marked incoordination persisted for from 2½ to three hours and slight incoordination persisted for as long as six hours.

A dose of 150 gm. (approximately 344 mg./kg.) was given to one horse. This horse was able to stand following administration, but four hours after it was still incoordinate.

There were no significant changes in pulse rate or respiratory rate.

Appearance of Mephenesin in the Urine After Administration

Urine samples were taken at various intervals after administration in seven experiments on three horses. Two hundred ml. aliquots were analyzed for mephenesin according to the method of Titus, *et al.*[1]**. No attempt was made to determine total urinary excretion. The doses used were 4 gm. (approximately 8.3 to 9.2 mg./kg.) intravenously and 20, 36, 100, and 150 gm. (approximately 41, 82.5, 208, and 344 mg./kg.) orally. Urine taken two hours after administration (oral or intravenous) always contained the drug, while none was detected in samples taken 24 hours after administration. The earliest sample taken was 1½ hours after oral administration of 20 gm. and 0.14 mg. of mephenesin was recovered. At 3½ hours after this dose only a trace was found in the urine aliquot. Following a dose of 36 gm. orally, 0.26 mg. was recovered in the urine sample taken at two hours after administration, 0.075 mg. at four hours and none at six hours. With the 100 gm. oral dose, 13.5 mg. were recovered from the four-hour sample and 0.6 mg. at 6½ hours postadministration. With the 150-gm. oral dose 8.1 mg. were recovered from a sample taken five hours postadministration and 1.25 mg. at eight hours after administration. Following intravenous administration of 4 gm., 2 to 3 mg. were recovered in the two-hour sample, 1.2 mg. at four hours, and 0.3 mg. at six hours. One horse was given two intravenous doses of 6 gm. two hours apart. The 200 ml. aliquot of urine taken two hours after the last dose contained 8.27 mg. of mephenesin.

Effect of Mephenesin on a Horse with Tetanus

A four-year-old Thoroughbred mare was admitted to the hospital with a severe case of tetanus of 24 hours standing. When first examined, the horse was sweating profusely, tail elevated, masseter muscles in spasm, and limb muscles somewhat rigid. The temperature was 102 F., pulse rate 60 and respiratory rate 28 per minute.

Fifty grams of mephenesin, given orally, produced diminution of rigidity lasting two hours, during which time the horse could lower its head and eat and drink. Three hours after this dose, sweating and rigidity had returned. Seventy grams of mephenesin were given through a stomach tube. Relaxation occurred within five minutes. The horse became incoordinated within 15 minutes but remained standing. All signs of tetanus were masked and relaxation persisted for six hours. Eight hours after this dose the rigidity had returned. A dose of 75 gm. was given orally, following which the animal lay down and remained remained relaxed for about three hours. At this time 40 gm. were given orally and this produced relaxation for about 2½ hours. The general condition of the horse had deteriorated and it was unable to rise. When rigidity returned and clonic convulsions developed the horse was narcotized with chloral hydrate. Despite supportive therapy it became worse and was killed 24 hours later.

Initially in this horse, oral doses of 50 and 70 gm. produced relaxation without recumbency and enabled the animal to eat and drink. As the disease progressed the animal became weaker and the effect of the drug less persis-

(Continued on page 424)

**These analyses were carried out by Mr. George Jaggard, Dalare Associates, Philadelphia, Pa.

EDITORIAL COMMENTS

Wisconsin Legislative Action on Brucellosis

In an unprecedented action, the Wisconsin legislative body passed a bill, to be effective on June 20, 1955, to the effect that at such time as 75% of counties in the state had voluntarily signed under the Federal-State Plan A for Brucellosis Control, that the entire state would be declared under restriction of program as outlined for Plan A. Since 75% of the counties had previously declared for Plan A the bill, when passed, had immediate effect. This requires that all reactors must now be removed promptly on information furnished by the seroagglutination test.

This decisive action is a move toward speedy clean up of brucellosis among Wisconsin dairy cattle. It indicates that one of our major livestock states is willing to take a firm grasp of a disease control matter. No partisan political power moves are evident in this commendable action, referred for consideration by other states, and which is likely to assure Wisconsin brucellosis-accredited status earlier than would have been possible otherwise.

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Action of Antibiotics in Poultry Nutrition

The manner in which antibiotics act to improve growth and economy of feed utilization has been sought in much investigational work. The action is known to be complex and has not been determined specifically.

In an address regarding the subject, Dr. R. C. Klussendorf, director, Veterinary Medical Services, Commercial Solvents Corporation, Terre Haute, Ind. presented at the Informal Poultry Nutrition Conference, San Francisco, Calif. a review of investigations in which was brought out numerous variables that appear to be influenced by management practices and types of antibiotics employed.

Seven distinct theories of antibiotic selectivity were discussed. These included: (1) Suppression of competitors for nutrient substances which are incapable of producing disease; (2) control of potentially dangerous organisms (pathogen); (3) stimulation of synthesizers, or organisms known to be capable of synthesizing nutrient substances and growth factors by their metabolism; (4) improvement of appetite; (5) enhancement of absorption either by effect on the intestinal mucosa or its contents; (6) the sparing action attributed to antibiotics resulting in improvement in utilization of essential nutrient factors; and (7) destruction of secondary invaders foreign to the normal, healthy, digestive tract.

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Poultry Disease Diagnostic Facilities

Results of an extensive survey of facilities for diagnosis of poultry diseases are reported in the current issue of the *Federal Veterinarian* (12:5 [July], 1955).

A group of specialists located in separate regions of the country collaborated with veterinarians of the Agricultural Research Service in determining the assurances existing in personnel and equipment for prompt service to poultry growers in the event of an emergency. The consolidated report reveals that there are now 93 laboratories operating in the continental United States (other than federal and commercial laboratories) in which poultry diagnostic work is performed. Less than 20% of these are adequately staffed or equipped for special work required in connection with the prompt diagnosis of foreign diseases or those having unusual aspects known to exist in the country.

Emphasized in the report was the possibility of accidental introduction of diseases not now existing here. It was pointed out that even though every effort was made to prevent introduction, absolute protection could not be expected.

Recommended was development of the regional laboratory plan for diagnosis and supervision of any control or eradication project. Also emphasized was the need for adequate facilities and competent personnel.

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Resistant flies may lose their acquired resistance to specific chemical, such as DDT, says Paul Dahm, research entomologist at Iowa State College, if other types of insecticides are widely used for some time. In this is suggestion that by altering types of insecticdes, two or more chemicals may suffice to control insect population indefinitely.

Harvest Mites, Chiggers and Red Bugs

By whatever name, the tiny arachnids, *Trombidium holosericeum* are responsible for much summer discomfort for man and beast.

The adult stage of Trombidium is free living, feeding upon juices of plants and small insects. Eggs are deposited in humid, shady spots, generally early in spring. Subsequent hatch is a parasitic larvae that attacks, in addition to insects and snakes, all warm blooded animals, detaching themselves from the undersides of leaves of weeds and grasses to attack bodies of animals as they pass through infested vegetation. Contrary to common concept, the mite does not burrow into the skin or suck blood. It attaches itself by mouthparts to depression in the skin, usually at the hair follicle, after which it injects a fluid which breaks down epidermal cells on which it feeds. It is this fluid, elaborated by the mite, that is responsible for the intense itching. Thereafter, the mite invariably perishes.

Chiggers are most troublesome during the late summer and fall; the name *Leptus autumnalis*, which the larval stage has been described, (Parasite and Parasitosis of Domestic Animals, Underhill) being derived from this fact.

Control of chiggers is rather simple with an array of new chemicals which are lethal to the tiny mites. Good results are reported on spraying open acres with toxaphene or chlordane at the rate of 2 lb. per acre. Repellents for individual protection actually kill chigger mites. Those containing dimethyl phthalate, dimethyl carbate, ethyl hexanedial, and others. All are effective when properly used. These new drugs also repel free-flying mosquitoes, gnats and biting flies. Smearing commercial preparations available most everywhere on shoe tops, bottoms of trouser legs, and other openings in clothing is helpful. Some preparations, especially designed for those who expose a relatively large portion of their limbs, are available for applying directly to the skin.

Hunting dogs frequently are attacked, as are horses and chickens. Dogs returning from the field often will exhibit symptoms of severe itching about the face and muzzle, paws, inner thighs, and belly. Sponging with appropriate insecticide will kill mites, after which itching rapidly subsides.

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The supply of feedstuffs, both concentrates and roughage, are considered ample for the reported increased numbers of animals on feed.

Medicaments in Poultry Feeds

"The feed industry has responded to pressure from the field to make available medication via the feed route. Original reluctance has given way to general acceptance of the concept that the industry must be willing to provide whatever medication is vital for economical and good quality poultry production. Providing such feeds is a service which the feed industry must perform regardless of the problems involved. These include: Problems of inventory, problems of multiplication of feed lines, problems of mixing, problems of registration and labelling, and problems of education and explanation for proper use. Yet, provision of the medicated feeds is a justifiable demand of the grower."—*Nut. News. Bul., July '55.*

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Coal-Tar Disinfectant Poisoning in Chicks

Dr. M. W. Osburn, Kansas extension veterinarian, warns practitioners of potential hazard of coal-tar disinfectants in poultry houses, especially those used for brooding.

Intoxication is produced in chicks by inhalation of fumes from volatilized disinfectant in heated brooder houses. Symptoms of depression, labored breathing, coughing, gasping, and rales are observed, and may be confused with infectious bronchitis and Newcastle disease. Primary postmortem lesion is collection of gelatinous, straw-colored fluid beneath the skin.

Evidence now indicates that treatment of brooder houses with coal tar disinfectants, brooders started and chicks moved in, all in rapid succession, may cause injury.

Toxic symptoms are relieved promptly if detected early by providing adequate ventilation or moving to other quarters.

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Dr. Thomas M. Peery, George Washington University, Washington, D. C., reports that a significant percentage of damaged hearts now attributed to rheumatic fever may actually be the result of human brucellosis. These conclusions, as reported briefly in *Science News Letter* for July 9, 1955, are established on studies of patients, case histories, and autopsy results. In this is suggestion that brucellosis can not be considered as an occupational disease alone, but also has important public health implications.

Entertoxemia of Cattle

Enterotoxemia of cattle, a type of toxemia, similar to the anomaly common to sheep, may be a significant and too-frequently undiagnosed condition of feedlot cattle. It might now be confused in the shipping fever complex, responsible for major losses in the corn belt.

Dr. James E. English of the School of Veterinary Medicine, University of Missouri, Columbia, believes that preventive vaccination with the proper type of *Cl. perfringens* bacterin holds promise of reducing losses. Perfringens type D antitoxin has been employed for treatment, in a limited number of field cases, successfully.

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Effect of Certain Stress Factors on Livestock

Those in continuous contact with domestic livestock and pets are made conscious of the influence of certain management practices that have been known for a long time to influence adversely production realized from herds and flocks. These are now referred to as "stress factors". Dr. W. N. Miller, director of nutrition, A. E. Staley Manufacturing Co. outlined a group of these (Animal Welfare Institute-Information Report, May-June 1955) suggesting their unfavorable influence on the economy of livestock production. Those listed include: (1) Poor nutrition of parent stock, (2) improper preparation of dams for parturition, (3) chilling or overheating, (4) cold, damp floors, drafts, starvation, (5) faulty ventilation, (6) dehydration, (7) crowding, (8) low grade infections, (9) vaccination, castration, (10) medication (preventive or treatment), (11) culling, and (12) unsanitary quarters.

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Grass Silage

An appraisal of the value of grass silage is reported in Massachusetts Experiment Station Bulletin 477, which reviews 18 years of experience with this feedstuff.

Water content of the green corn is the most important factor influencing silage quality. Moisture below 60% is too dry and packets of mould develop on storage. Poor quality also develops in high moisture content (above 70%) unless precautions are taken. Molasses is no longer recommended as a preservative. Ground cereal grains are best conditioners and retain 80% of their nutritive value on storage with grass silage.

Kenney Direct

Foaled in 1922, now 33 years of age, Kenney Direct, world champion pacer in 1930 is now being cared for by Mr. Francis H. Matthews, Jr., Kansas City North, Mo., on his Clay County farm.

When five years of age Kenney Direct was sold for $10,000. He raced all over the country including California and was clocked at 1:59 for the mile at Lexington, Ky. in September 1930.

Now feeble and stiff, the grand old horse must be helped up in his stall but walks over a 40 acre pasture. The veterinarian who attends him regularly reports that eyesight is good but that the horse is toothless. A special ground diet is fed daily. Pulse is slow but strong. An anthelmintic is administered annually.

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Limited consideration has been given at recent infertility conferences, in several widely separated places, to brucellosis as a cause of abortion and infertility in cattle. One is impressed with marked contrast in the character of discussions on the subject now and that of a brief few years ago. Drastic lowering of incidence of brucellosis has resulted in focusing the attention spotlight to the now more important etiological agents — Trichomonas and *Vibrio fetus*.

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The Secretary of Agriculture has asked for authority to dispose of 100,000,000 bushels of low-grade government surplus wheat for animal feed. Prices proposed are 10% above support price for corn, which will tend to equalize corn and wheat on a comparable feed value basis.

Dean Leasure on International Cooperation Administration Team

Dr. E. E. Leasure, dean, School of Veterinary Medicine, Kansas State College, left Manhattan July 17 as member of a team of three Americans to visit India for the International Cooperation Administration (formerly FOA).

Dean R. E. Buchanan of Iowa State College and Dr. A. H. Moseman of the USDA's agricultural research service with Doctor Leasure constitute the team selected for a three month's survey of all sections of India and make recommendations to ICA with respect to research, teaching, and extension programs that might be carried out by the central government.

They will work with the Indian Ministry of Food and Agriculture, state ministries, colleges, and other Indian institutions.

Five Indian government officials who have spent some time observing land-grant and extension programs in the United States, and one member of the International Cooperation Administration, will work with the American team of three in formulating recommendations.

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Erratum

The statement appearing in a brief note under the heading Chick Embryo Culture Rabies Vaccine for Human Use, (*Vet. Med.*, 50:XLIII [May] 1955) is in error in that it infers comment in regard to human rabies vaccine. The results published in the original article cited apply to the use of the Flury strain vaccine in dogs.

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Improved Efficiency of Poultry Rations

Addressing the American Farm Research Association meeting in St. Paul, Minn., Mr. E. V. Stevenson, manager of the feed department, Illinois Farm Supply Company, stated that broiler feeding efficiency has increased nearly 100% in the last 25 years. Egg production has jumped from 154 to 224 eggs per 100 lb. of feed, which means a savings of 11¢ per dozen in feed cost during the same period.

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The hormone, dienestrol diacetate (lipomone), has been cleared for inclusion in poultry feeds at a level of 63.5 gm. per ton.

Abortion in cattle resulting from trichomoniasis usually occurs early in the gestation period, between three and 16 weeks. Vibriosis may be the cause of abortion at any time, but most frequently occurs between four and six months pregnancy.—*C. J. Bierschwall, D.V.M.*

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Mephenesin in Horses

(Continued from page 420)

tent. It did not appear to alter the course of the disease significantly in this case.

Summary

Two horses, fed 100 gm. of mephenesin daily for 36 days, exhibited no clinical or postmortem evidence of chronic toxicity.

Intravenous doses of 4 gm. caused sedation in most horses and incoordination lasting up to 35 minutes. Two gram intravenous doses given ten to 25 minutes apart did not produce a cumulative effect. An oral dose of 36 gm. (approximately 82.5 mg./kg.) caused mild transient incoordination. Seventy-two and one-half grams (approximately 166 mg./kg.) orally caused marked incoordination and doses of 100 and 150 gm. (approximately 206 to 229 and 344 mg./kg.) caused incoordination and sedation lasting up to six hours.

In a horse with tetanus, oral doses of 50 and 70 gm. masked the signs of tetanus for several hours.

Following oral administration, mephenesin appeared in the urine as early as 1½ hours. Mephenesin could be detected in urine samples taken two hours after oral or intravenous administration while samples taken 24 hours later were always negative. The amount and persistence of the drug in urine varied with the dose and route of administration.

Acknowledgment

The authors are indebted to the following veterinarians (then senior students) for aid in carrying out this work: Drs. S. Gerard, D. Ingraham, W. Nehoda, R. Reichard, and D. Snyder; and to Dr. J. Z. Edelblut, who carried out the observations on the horse with tetanus.

REFERENCE

1. Titus, E., Ulick, S., and Richardson, A. P., The Determination of 3-(orthotoloxyl)-1,-2-propanediol (Myanesin) in Body Fluids and Tissues, and its Disappearance from Blood Following Intravenous Injections in Dogs. *Jour. Pharmacol. and Exper. Therap.*, 93:129, 1948.

PRINCIPLES OF ANIMAL HEALTH

R. R. DYKSTRA, D.V.M.
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Newcastle Disease in Man

Evans in *American Journal of Public Health* for June 1955 writes informatively about "Pathology and Immunology of Newcastle Disease Virus (NDV) in Man. Tentatively, he offers the following: "In my opinion NDV is only capable of producing conjunctivitis in man with its occasionally attendant systemic symptomotology. The possibility of mild respiratory illness due to this virus cannot be entirely excluded . . . " In the matter of diagnosis of suspected human infection he states, "A properly conducted neutralization test is, in my opinion, the laboratory technic of choice."

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Veterinarians in general are aware of a regulation by the Federal Food and Drug Administration that, for a period of 48 hours previous to slaughter, cattle that have been receiving stilbestrol should not be allowed this agent so that the meat and edible portions may be entirely free from this synthetic sex hormone. Neither should it be fed to breeding animals.

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Footrot in Sheep

From the *British Veterinary Journal* of May 1955 we gather two points of significance in the clinical handling of footrot in sheep.

Dr. S. T. Harris of the Ministry of Supply Establishments summarizes his project regarding the use of chloromycetin®[1] as a footrot remedy by stating that, "The application to the affected feet of chloromycetin, in concentrations of 1% and 0.5% in alcoholic solution, possesses no advantages over 10% copper sulphate solution as a foot bath."

Doctor Harris in summing up treatment with terramycin®[2] avers, "The application of terramycin in the form of an ointment containing 5 mg. of terramycin and 10,000 units of polymyxin B sulphate per gm. (we were unable to find this preparation listed in the 1953 British Veterinary Codex (R. R. D.) was found highly effective against the common form of footrot in sheep."

®[1]Parke, Davis & Co., Detroit, Mich.
®[2]Charles Pfizer & Co., Brooklyn, N. Y.

Insemination of *Vibro fetus* Infected Cows

Edgson and Scarnell, as reported in *The Veterinary Record* of June 18, 1955, state that the handling of *Vibrio fetus* infection in the bull by means of topical application of an antibiotic emulsion has been followed by good results in their research. In general, the basis for the local application of these agents is the assumption that, in the bull, the spirillum is localized only in the lining of the prepuce and on and in the glans penis and the urethra. Admittedly the authors concede that this localization has not been demonstrated conclusively.

Haubrich, as reported in the *Cornell Veterinarian* for July 1955, states that semen from *V. fetus* infected bulls can be made safe for use by adding a solution of dihydrostreptomycin. Cows carrying infection are handled by him with a uterine infusion of a combination of dihydrostreptomycin and pencillin.

Some veterinarians report that they bypass low grade vaginal and cervical infections (presumably the uterus and tubes are clean) by introducing the semen into the uterus via the rectum. The rectum is cleaned as thoroughly as possible. Semen contained in a hypodermic syringe is introduced after protecting the tip of the needle with a cork stopper. The uterus is brought in contact with the rectal wall by lifting manually, protecting cork is removed, and the needle pushed through the walls of the rectum and uterus so that the semen may be deposited deep into the uterine cavity.

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Toxic Hypervitaminosis A

Vitamins may prove to be toxic when extremely large repeated doses are given. In the Arctics, explorers that continued to eat livers of Arctic animals, a food item said to be shunned by Eskimos, became affected with hypervitaminosis A. The *Canadian Medical Association Journal* (5:500, 1955) reports a case of this nature in which the patient exhibited neurological, skeletal, and skin changes that disappeared quickly when the excess dosage, as much as 500,000 units daily, was discontinued.

POULTRY PRACTICE PROBLEMS

W. R. HINSHAW, D.V.M., Ph.D.
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Toxicity of Organic Seed Protectants

Ackerson and Mussehl (*Poultry Science*, 34:728, 1955) of the University of Nebraska tested the toxicity of two common seed corn protectants, tetramethyl thiuram disulphide (arasan)® and N-trichloromethylthiotetrahydrophthalamide (orthocide)® for young chickens. They found that the former (TMTD), known by the trade name of arasan, fed at levels used for seed corn, caused a depression in growth rate evident from the beginning and persisting until the protectant was withdrawn. Then when placed on a normal ration, the chickens recovered and grew at a normal rate. The second compound, known commercially as orthocide, caused a temporary slowing of growth for three weeks, but by the end of 28 days they had recovered and were of equal weights to the controls. The reason for making these toxicity tests was to determine if surplus treated seed corn, often used for feeding purposes, was safe, if fed with washing as is recommended if used at all.

Without knowledge of Ackerson and Mussehl's research, three investigators at the University of Minnesota, Waibel, Pomeroy and Johnson, were simultaneously investigating a disease-like condition in a flock of laying chickens which proved to be caused by surplus seed corn treated with arasan (*Science*, 121:401, 1955). These investigators observed that the flock in question was laying large numbers of soft shelled eggs and many abnormal eggs with shells. Subsequently they showed that the seed protectant in the feed was responsible for the effect on egg production and egg quality, and were able to reproduce the condition by giving the chemical in feed in quantities as low as 35 p.p.m. Fully treated seed corn contains about 630 p.p.m. of TMTD so toxicity and premature expulsion of eggs can occur in feed to which has been added very small quantites of the chemical agent.

The only symptoms noted in the Minnesota studies were almost immediate drop in egg production, the presence of large numbers of soft-shelled eggs laid during the night, and many misshapen and poor shell quality eggs. No toxic symptoms were noted. Within two weeks after return to a normal diet the production returned to a near-normal quality and production level. The chicks given the TMDT in the Nebraska trials exhibited only mild symptoms described by the investigators as "knock-kneed," walked with a stilted gait, and rested on their hocks in a different manner than normal chicks.

One other report of possible TMDT toxicity in a small flock of chickens is that of Cottier (*Auburn Vet.*, 10:115, 1954). Drop in egg production, premature expulsion of soft shelled eggs and misshapen eggs is commonly associated with such infectious diseases as Newcastle disease, infectious bronchitis, and avian mononucleosis, as well as with the feeding of many drugs, and especially certain of the sulfonamides. These must be eliminated in making a diagnosis.

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Avian Encephalomyelitis (Epidemic Tremors)

At the 39th annual meeting of the American Poultry and Hatchery Federation meetings held in Kansas City during the week of July 18, 1955, Dr. Erwin Jungherr made an appeal for the poultry industry to take immediate, positive action to stamp out avian encephalomyelitis (epidemic tremors) (*Poultryman*, 24:1 [July], 1955). Doctor Jungherr pointed out that because of the small size of the virus causing this disease, there is little hope of discovering a treatment for it. There is hope, according to him, of finding a method of determining and eliminating adult carriers thus preventing egg transmission which is known to exist. He also urged that research be supported on possibilities of immunizing flocks against the disease.

According to Jungherr, epidemic tremor usually hits its peak of incidence twice a year —spring and fall. Symptoms turn up when the birds are between two and 25 days of age, or on the average of 16 days. Infected birds may be distinguished by a rapid, fine trembling of the head, neck and body, or lameness in both legs.

All available evidence, indicates that transmission occurs from the parent stock through the egg to the chick. There is, however, little spread from chick to chick and ordinary precautions are usually enough to keep the disease confined.

VETERINARY PARASITOLOGY

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Phenothiazine Particle Size

Current researches both in Australia and the United States appear to have caused concern among veterinarians and others about the practical bearing of particle size of phenothiazine upon the efficacy and net usefulness of this anthelmintic. Only the meagerest accounts of these researches have been published and it is therefore as impossible to evaluate their significance as it is unwise to anticipate their full import.

If it should prove that fine particulation is therapeutically advantageous, which is certainly a possibility if not a probability, problems must be solved regarding economy, safety, and general usage of products of fine particle size. To offset the increased production cost of products having particle diameters of 10 microns, for example, lower dosages than those now used must prove effective. Any favored product, moreover, must not increase the hazard of intoxication. The further problem of whether or not fine particle size could enhance or vitiate the efficiency of free-choice and low-level methods of administration is, in this country at least, pertinent to practical usage.

But the problem is not a new one. In a dozen or more articles, dating back to the insecticidal use of phenothiazine in 1939, reference has been made to the effect or possible influence of particle size on the efficiency of the chemical. Excepting the Australian and California researches, however, there is no evidence that micronized or finely divided products are superior to the standard products available for anthelmintic use.

There is, moreover, no discernible basis for apprehension about the efficacy of present N. F. products. These probably average about 45 microns in particle size and about 60% is probably of a particle size that averages about 10 microns. The situation, then, does not pit a new product against an old, ineffective one, but a part against the whole, as it were, and either product, when used in equivalent doses of a 10-micron product, should achieve about the same efficacy. If, then, it should be found that a product averaging 10 microns is 25% more efficient than the N. F. product in standard doses, as might obtain, for example, against Ostertagia or Trichostrongylus in sheep, one could presume that larger than standard doses of the N. F. product would exhibit greater efficacy against these parasites. This has been shown to be the case. In short, if one should find that no action can be ascribed to particles that exceed 50 microns, the refined product should achieve the same action as the N. F. chemical when employed in doses only 3/5 as large, say 15 gm. for sheep instead of 25. Also, 25 gm. of the fine product should be about as effective against Ostertagia and Trichostrongylus as 40 gm. of the N. F. compound. Against some species, of course, such as Haemonchus in sheep, the N. F. product in usual doses leaves little to be enhanced.

Finally, it seems not unlikely that less phenothiazine passes unchanged through an animal when a fine product is used. Likewise one may postulate greater absorption of the compound. These considerations could eventuate in the employment of a finely divided product for therapeutic purposes and a standard (or even coarser) one for low-level and free-choice administration. Consequently, on the assumption of a correlation between efficacy and fine particle size (barring the unlikely event of new uses or actions), the prospect and extent of using products of fine particle size may primarily depend on considerations of economy and convenience. It is axiomatic, however, that a drug that enjoys wide and continuous use undergoes change and refinement, but this evolution is rarely cause for concern.

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Subclinical Trichostrongylosis of Sheep

Lowered digestibility of protein and depression of appetite are means whereby worms retard weight gains of their hosts. This interpretation is supported by controlled experimental studies with subclinical infections of *Trichostrongylus axei* in twin lambs[1]. In the infected animals, dry-matter digestibility coefficients were lowered although there was no effect on crude fiber, and appetite was reduced about 8%.

[1]Spedding, C. R. W., Effect of a Sub-Clinical Worm-Burden on the Digestive Efficiency of Sheep. *Jour. Comp. Path. and Ther.*, 64:5, 1954.

VETERINARY NUTRITION

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Meat Flavors

From time to time, we hear comments on the loss of flavor in meat and meat food products which we buy today. The meat doesn't taste like it did "when I was a boy". Not much scientific data are available to explain this observation. This opens the field for interesting speculation. There might be some merit to the idea that our present day feed ingredients are different. The big variable, which might be significant, is the widespread use of solvent-extracted oilmeals as sources of protein for present day feeds. The removal of these fats might conceivably have an effect on the tastiness of meat.

A more likely explanation is based on the earlier marketing of meat animals and poultry made possible by the use of high-energy rations. With these rations, we can market poultry in 10 to 12 weeks instead of 16 to 18 weeks. Hogs can be marketed at five months instead of nine months. The younger animals are just not as tasty as the older ones.

For the most part, we are cultivating "milder" tastes, so that we now expect the milder tasting meat. Long-cured hams are not as popular as they used to be. There are still some of us though, who long for the good, old, tasty meats, but most of us seem to be taking our taste preference cues from the cigarette advertisements — "They're milder and taste better".

Somehow we can not comment on the subject of taste in meat without referring to refrigeration. We always have had a feeling that much of the "gamey" taste of venison was a result of carrying the "bag" on the fender of the car in close proximity to the hot engine for a few hundred miles before final butchering. For poultry and domestic meat animals, our present day refrigeration prevents the development of this type of flavor.

Modern day progress — high energy rations which makes possible earlier marketing at lower production costs but with accompanying loss of flavor is sacrifice of a desirable property for efficient production. Progress then means, that in the matter of taste too, "we're milder."

Salt Poisoning in Pigs

Salt poisoning symptoms will develop in pigs on a ration containing 2.5% salt, according to work done at the Ontario Veterinary College. If the pigs are consuming less water than they should, toxic symptoms will develop if only 2% salt is added to the ration.

The serum sodium is high. Since the same symptoms can be produced with sodium propionate, sodium is thought to be the important factor.

Blindness and epileptiform fits are the most important observable symptoms.

Treatment consists of small amounts of drinking water offered frequently. A large volume of water taken at once will aggravate symptoms.

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Hutchings and coworkers at Purdue report that small amounts of nitrophenide will cause complete paralysis in pigs. This product is commonly used in poultry feeds as a coccidiostat. If it is fed to pigs accidentally, these toxic symptoms may develop.

Pigs continue to eat, and will recover completely if non-medicated feed is brought to them and hand fed.

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Hanson and Ferrin of Minnesota report (*Jour. An. Sci.*, 14:43, 1955) that urea causes no significant effect on live weight gains when added to a low protein ration for weanling pigs at a 1.5% level. No toxic symptoms were observed in pigs fed the ration with urea.

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Reports of recent studies at Purdue University indicate that when cattle are put on rations containing urea, it may take two weeks for them to "adjust" to the feed. This same observation was made when cattle were put on experimental rations containing 75 mg. of antibiotic.

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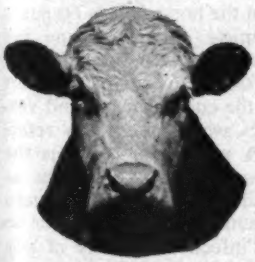
The addition of 0.02% arsanilic acid to a pig ration apparently protects the pigs from selenium poisoning, according to Wahlstrom, Kamstra, and Olson. (*Jour. An. Sci.*, 14:105, 1955.

REPORT ON
RECENT RESEARCH

Light worm loads are putting a serious drag on most "healthy" cattle



**Two-year tests were conducted on 600 lightly parasitized calves. Those treated with phenothiazine under the two-way program produced better gain than the untreated group.*

Tests show that stomach worms are robbing cattle of growth and vigor, stealing profits from practically every herd in the country . . . even in the colder northern states. While most of the infections are light, and few animals show clinical symptoms, the conditions represent a substantial part of the ½ billion dollars lost annually to internal parasites.

Now, field studies* prove that much of this loss can be prevented. A two-way program of control with the anthelminthic phenothiazine is recommended. First, use therapeutic doses of the drug to eliminate adult worms; then keep down reinfection and suppress the production of viable parasite eggs with low-level feeding of phenothiazine in supplement, mineral mix, or salt.

NEW INFORMATION ABOUT INTERNAL PARASITES, a review of developments in livestock parasitology is compiled periodically by the Du Pont Company for veterinarians and animal health specialists. To receive it regularly—or for specific information on the control of internal parasites with phenothiazine, simply write to E. I. du Pont de Nemours & Co. (Inc.), Grasselli Chemicals Department, Animal Industry and Nutrition Section, Wilmington 98, Delaware. Phenothiazine products are available through suppliers of veterinary products.

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Phenothiazine

BOOK REVIEWS

Books reviewed in this department and any other books, if available, may be obtained by remitting the published price to the Book Department, Veterinary Medicine, Suite 803 Livestock Exchange Building, Kansas City 2, Missouri.

PHYSIOLOGY OF DOMESTIC ANIMALS, by *H. H. Dukes, D.V.M., M.S.*, Professor of Veterinary Physiology, New York State Veterinary College, Cornell University, Ithaca, 1020 pages, 238 illustrations, 7th ed. Comstock Publishing Associates, Ithaca, N. Y., publishers—Price $9.75.

Beyond the requirements, because of sell-out of the previous edition (6th-1947), the author of this text explains that continuous research activity in practically all fields of physiology has influenced extensive revision and the publication of a more complete book on physiology. A new chapter is included that deals with water, electrolytes, and acid-base balance and a section is devoted in this edition to Intermediary Metabolism. Otherwise there have been extensive rewriting and arranging of subjects under appropriate headings, all usefully illustrated.

Specialists, teachers, and students will find the 29-page appendix setting forth explicit directions for lecture demonstrations valuable. Reference lists are appended to each of nine separate parts, or sections. Each of these treat specific body systems: Blood, respiration, digestion and absorption, et cetera.

This revised book on physiology is a welcome one that brings the latest information available into one dependable volume.

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RESTRAINT OF ANIMALS, by *John R. Leahy, D.V.M., M.S.*, and *Pat Barrow, M.S.*, New York State Veterinary College, Cornell University, 2nd ed. Cornell Campus Stone, Inc., Ithaca, N. Y., publishers. —Price $3.50.

Demand required a second printing of this little wire-bound book intended originally to supplement clinical demonstrations on restraint of animals. The simple, line drawings it included (over 300) clearly illustrated acceptable technic for control of domestic animals.

Before releasing the second edition, a chapter on restraint of sheep and goats was included, as well as a final one on handling laboratory animals.

Text material is brief, concise, yet sufficiently explanatory. The drawings tell the story.

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REGIONAL AND APPLIED ANATOMY OF THE DOMESTIC ANIMALS. PART I: HEAD AND NECK, by *John A. Taylor,* M.R.C.V.S., Senior Lecturer in Anatomy Royal (Dick) Veterinary College, Edinburgh. Oliver and Boyd, Ltd., Tweeddale Court, Edinburgh, Scotland, publishers, 1955. — Price 25/ (Approx. $4.)

This book is the first of a series of three volumes. Those to follow will deal with the limbs, the thorax, and abdomen.

This rather small but comprehensive text of the head and neck consists primarily of a series of plates of various regions with nerves and vessels shown in color. Opposite plates is description which, with one or two exceptions, is brief and to the point. The number of regions described is reflected in the number pages used for each species. The first 70 consider the head and neck of the dog. The description of the eye covers 17 pages and that of the ear seven pages. Six pages are used in describing the teeth. The section on the horse covers 60 pages with the most complete descriptions on the sinuses, teeth, and larynx. Nine pages consider various features of the ox. The major effort in this species is on the cornual nerve and vessels. Included in this section are a few references to the pig. A notable omission is the bovine eye. Perhaps "cancer eye" is not as common in Scotland as it is in midwestern United States. The author states, in relation to the frontal sinus:—"infection is rarely of any significance." The importance of this statement is reflected in the brief description and lack of adequate illustrations of the frontal sinus. A plate entitled, Lateral Aspect of the Pharynx and Root of the Tongue with its description is of little practical value. The nine pages on the sheep describe the frontal sinus and the brain.

Since the approach to anatomy is from the applied viewpoint, this book should be useful to both the anatomist and the surgeon. It is a valuable addition to veterinary literature.—*W. M. McLeod, D.V.M.*